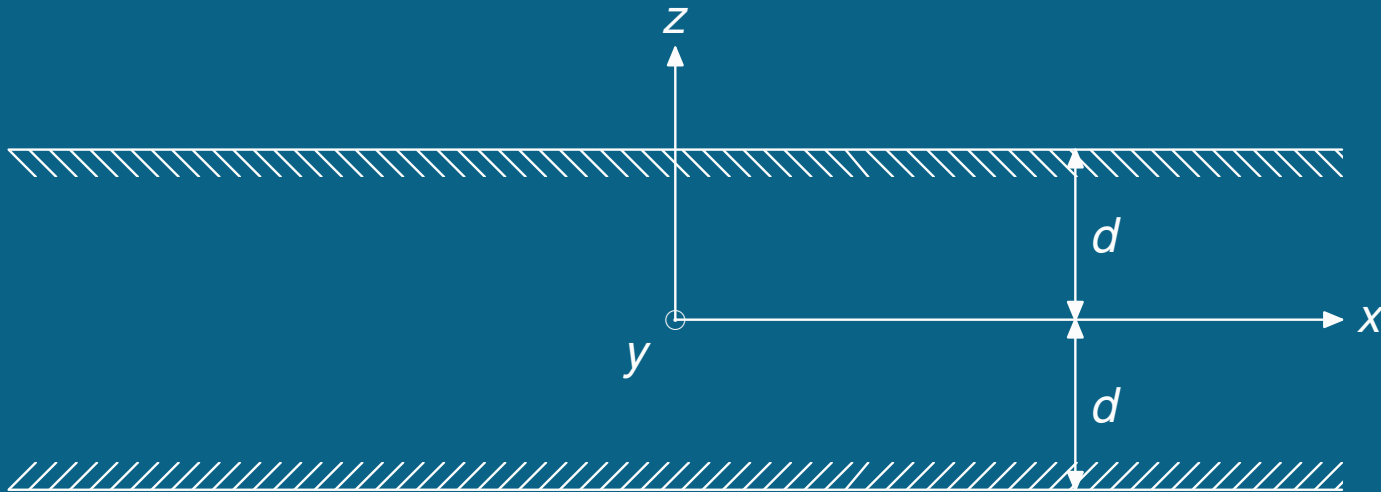


PROBLÉMY PŘI VYŠETŘOVÁNÍ NAPJATOSTI TLUSTÉ ORTOTROPNÍ DESKY

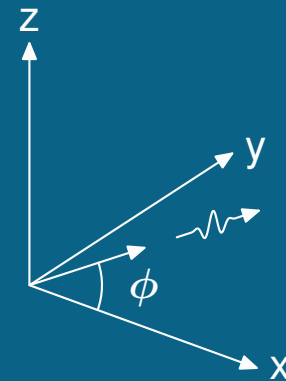
O. Červená, P. Hora
Ústav termomechaniky AV ČR, v.v.i.

Příspěvek vznikl na základě podpory projektu GA ČR č. 101/06/0213
Nestacionární napjatost a disperzní vlastnosti ortotropních těles a záměru
ÚT AV ČR, v.v.i., AV0Z20760514.

Úvod



- nekonečná tlustá deska
- volné okrajové podmínky
- ortotropní materiál
- orientace (001)
- libovolný směr šíření v rovině desky



Disperzní vztahy pro obecný úhel šíření ϕ

- pro symetrické módy:

$$\cotg \left(l_z^{(1)} kd \right) A + \cotg \left(l_z^{(3)} kd \right) B + \cotg \left(l_z^{(5)} kd \right) C = 0,$$

- pro antisymetrické módy:

$$\tg \left(l_z^{(1)} kd \right) A + \tg \left(l_z^{(3)} kd \right) B + \tg \left(l_z^{(5)} kd \right) C = 0,$$

kde

$$A = \left(D_x^{(3)} D_y^{(5)} - D_x^{(5)} D_y^{(3)} \right) \left[D_z^{(1)} + \left(E_x^{(1)} - E_y^{(1)} \right) \cos \phi \left(c_{13} - c_{23} \right) \right] c_{44} c_{55},$$

$$B = \left(D_x^{(5)} D_y^{(1)} - D_x^{(1)} D_y^{(5)} \right) \left[D_z^{(3)} + \left(E_x^{(3)} - E_y^{(3)} \right) \cos \phi \left(c_{13} - c_{23} \right) \right] c_{44} c_{55},$$

$$C = \left(D_x^{(1)} D_y^{(3)} - D_x^{(3)} D_y^{(1)} \right) \left[D_z^{(5)} + \left(E_x^{(5)} - E_y^{(5)} \right) \cos \phi \left(c_{13} - c_{23} \right) \right] c_{44} c_{55},$$

$$\left. \begin{aligned}
 D_x^{(n)} &= \alpha_x^{(n)} l_z^{(n)} + \alpha_z^{(n)}, \\
 D_y^{(n)} &= \alpha_y^{(n)} l_z^{(n)}, \\
 D_z^{(n)} &= \alpha_z^{(n)} l_z^{(n)} c_{33} + \alpha_x^{(n)} c_{23}, \\
 E_x^{(n)} &= \alpha_x^{(n)} \cos \phi, \\
 E_y^{(n)} &= \alpha_y^{(n)} \sin \phi, \\
 \alpha_x^{(n)} &= c_{33} g_1 l_z^{(n)4} + (g_1 g_2 + c_{33} g_3 - g_4^2) l_z^{(n)2} + g_2 g_3, \\
 \alpha_y^{(n)} &= -c_{33} g_5 l_z^{(n)4} + (g_4 g_6 + c_{33} g_7 - g_2 g_5) l_z^{(n)2} + g_2 g_7, \\
 \alpha_z^{(n)} &= \left((g_4 g_5 - g_1 g_6) l_z^{(n)2} - (g_3 g_6 + g_4 g_7) \right) l_z^{(n)},
 \end{aligned} \right\} \text{ pro } n = 1, 3, 5$$

$$g_1 = \sin^2 \phi c_{55} + \cos^2 \phi c_{44},$$

$$g_2 = \sin^2 \phi c_{44} + \cos^2 \phi c_{55} - \rho c^2,$$

$$g_3 = \sin^2 \phi \cos^2 \phi (c_{11} - 2 c_{12} + c_{22} - 4 c_{66}) + c_{66} - \rho c^2,$$

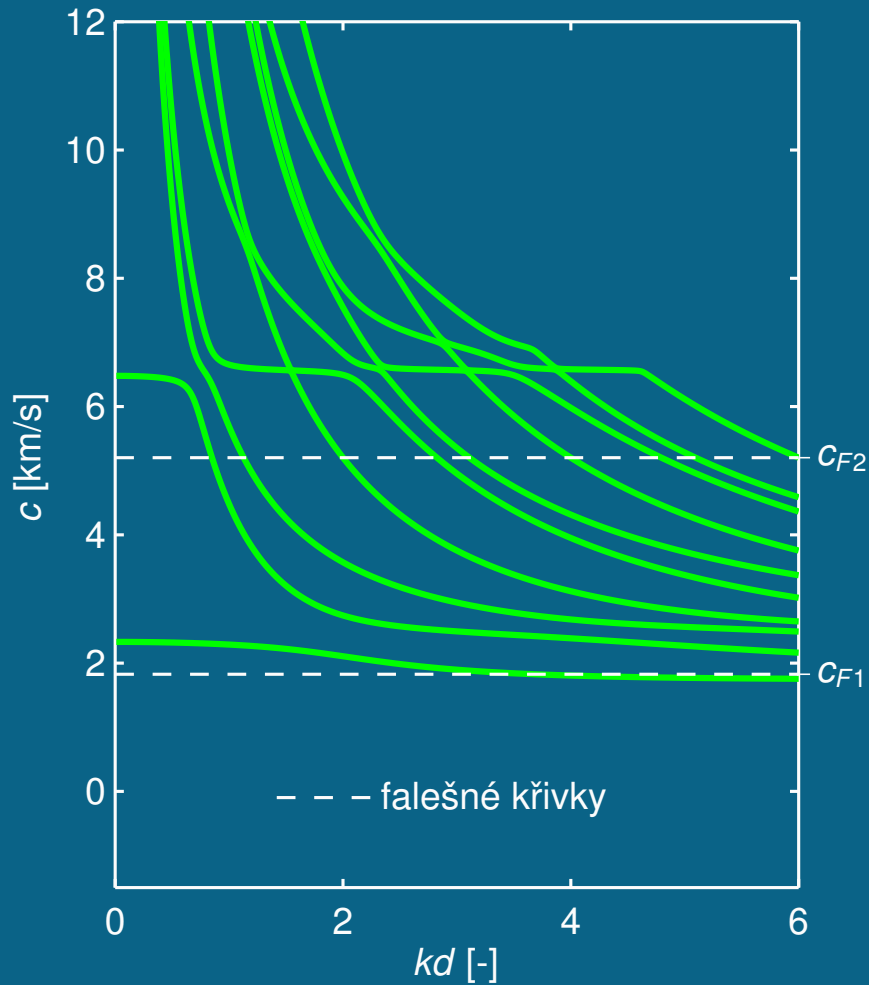
$$g_4 = \sin \phi \cos \phi (c_{23} - c_{13} + c_{44} - c_{55}),$$

$$g_5 = \sin \phi \cos \phi (c_{44} - c_{55}),$$

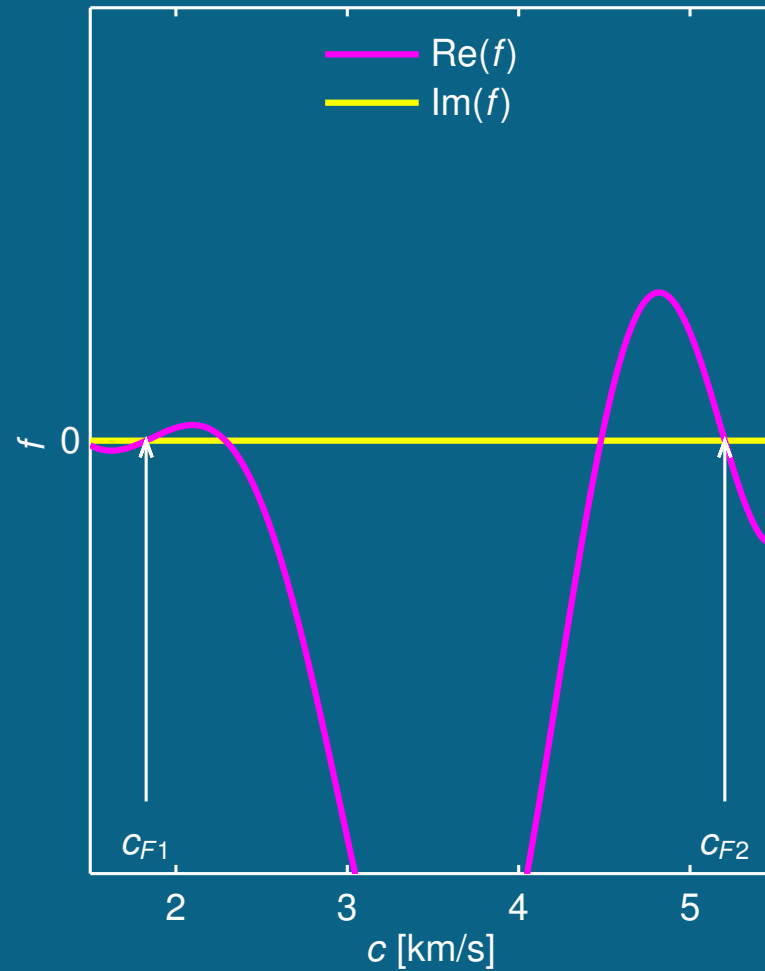
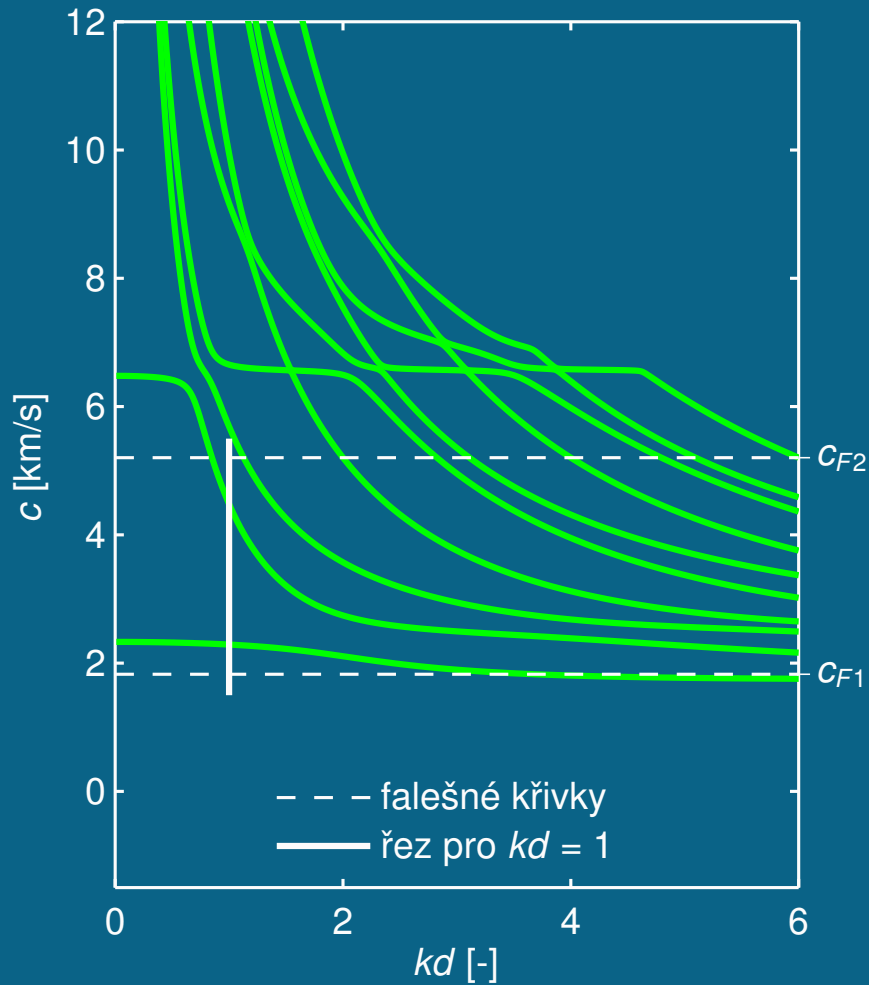
$$g_6 = \sin^2 \phi (c_{23} + c_{44}) + \cos^2 \phi (c_{13} + c_{55}),$$

$$g_7 = \sin \phi \cos \phi (c_{12} - c_{22} + 2 c_{66} + (c_{11} - 2 c_{12} + c_{22} - 4 c_{66}) \cos^2 \phi).$$

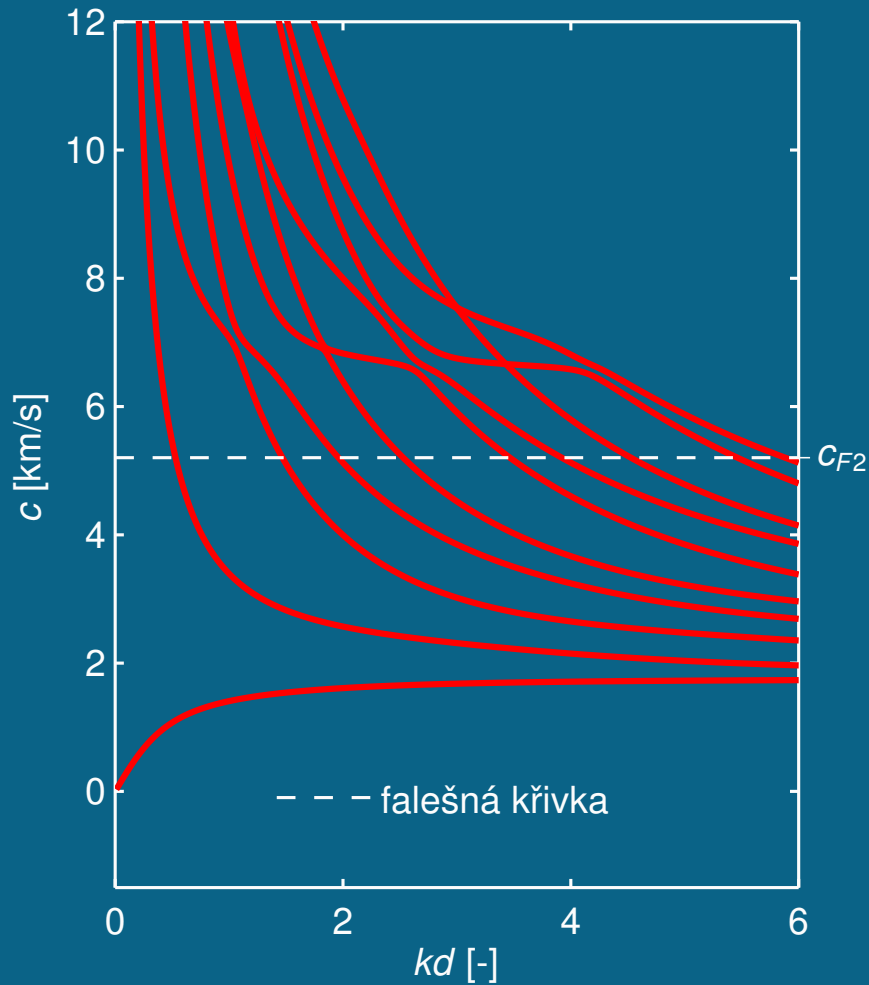
Disperzní křivky pro symetrické módy směr šíření $\phi = 45^\circ$



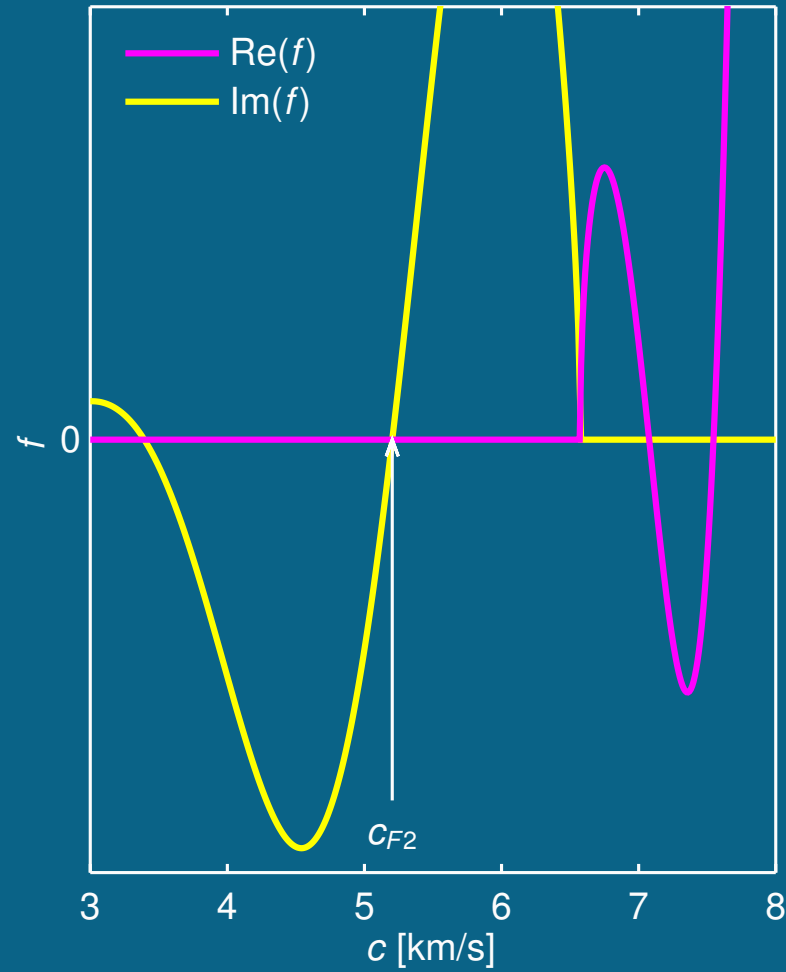
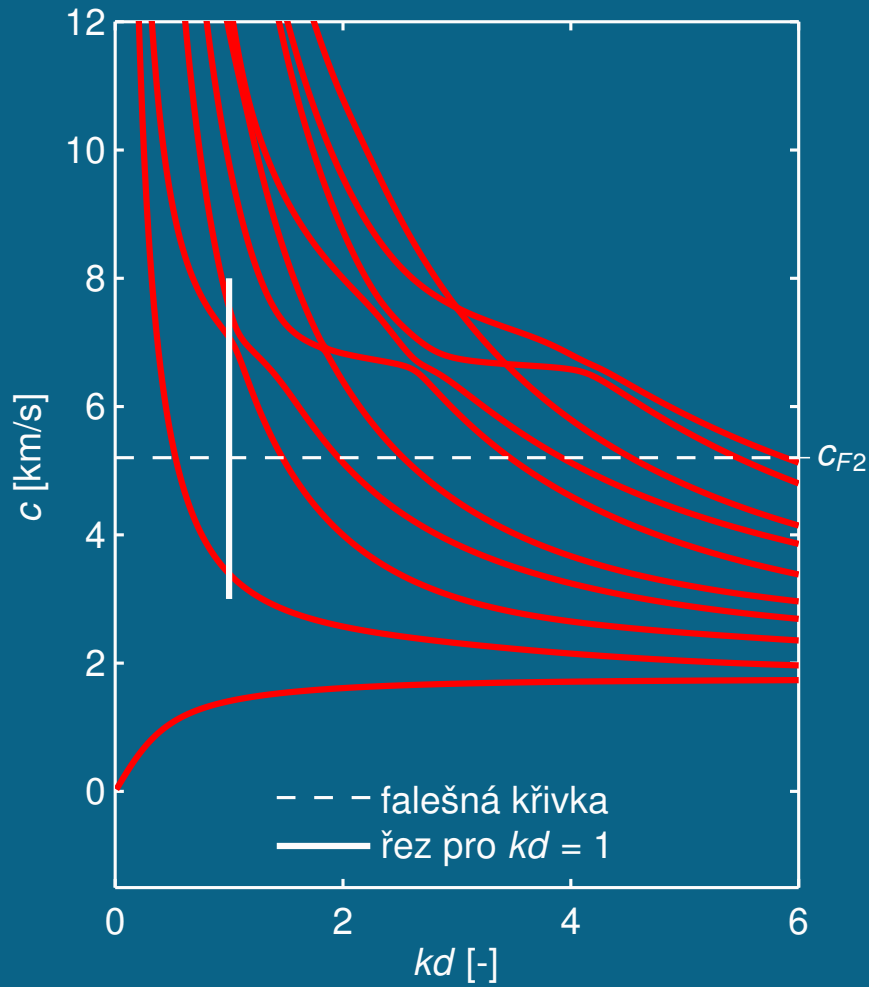
Disperzní křivky pro symetrické módy směr šíření $\phi = 45^\circ$



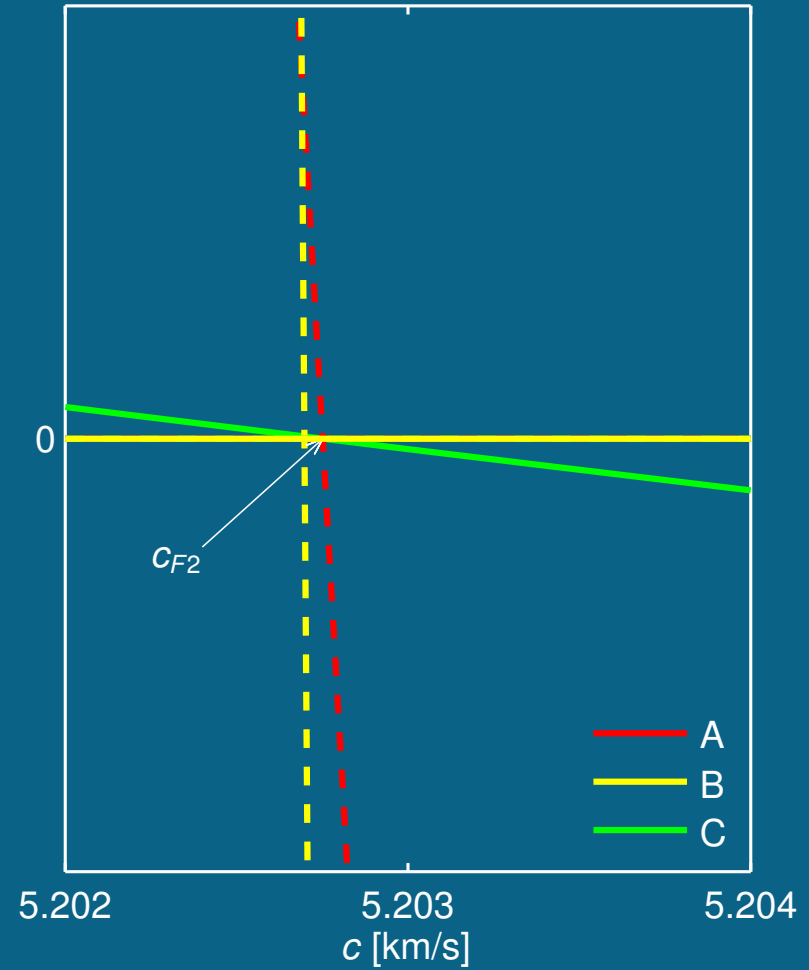
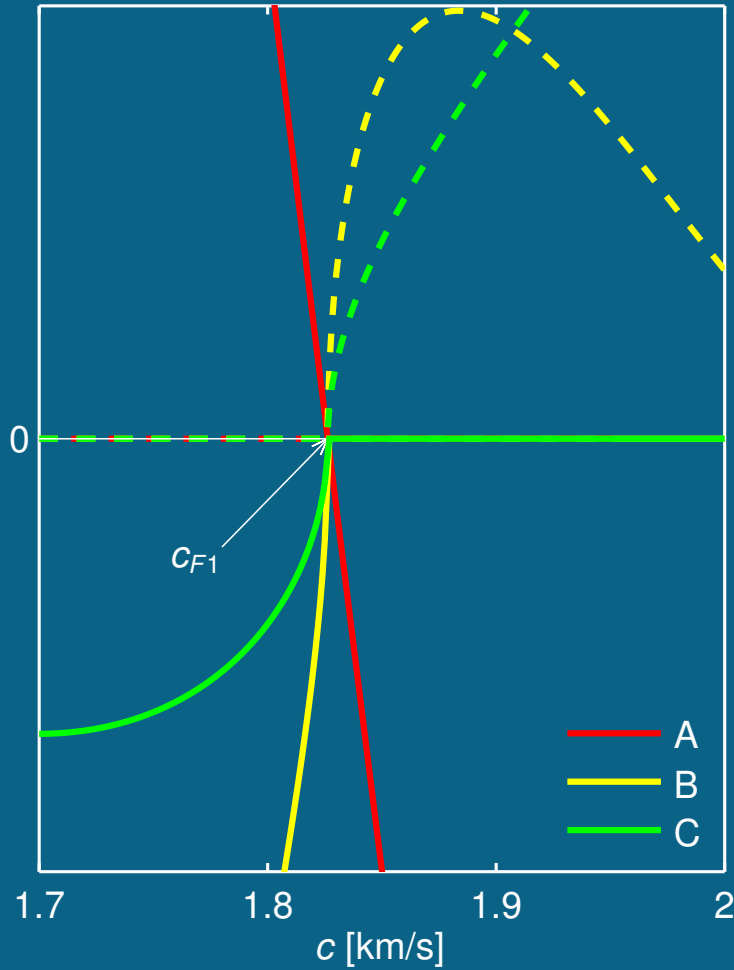
Disperzní křivky pro antisymetrické módy směr šíření $\phi = 45^\circ$



Disperzní křivky pro antisymetrické módy směr šíření $\phi = 45^\circ$



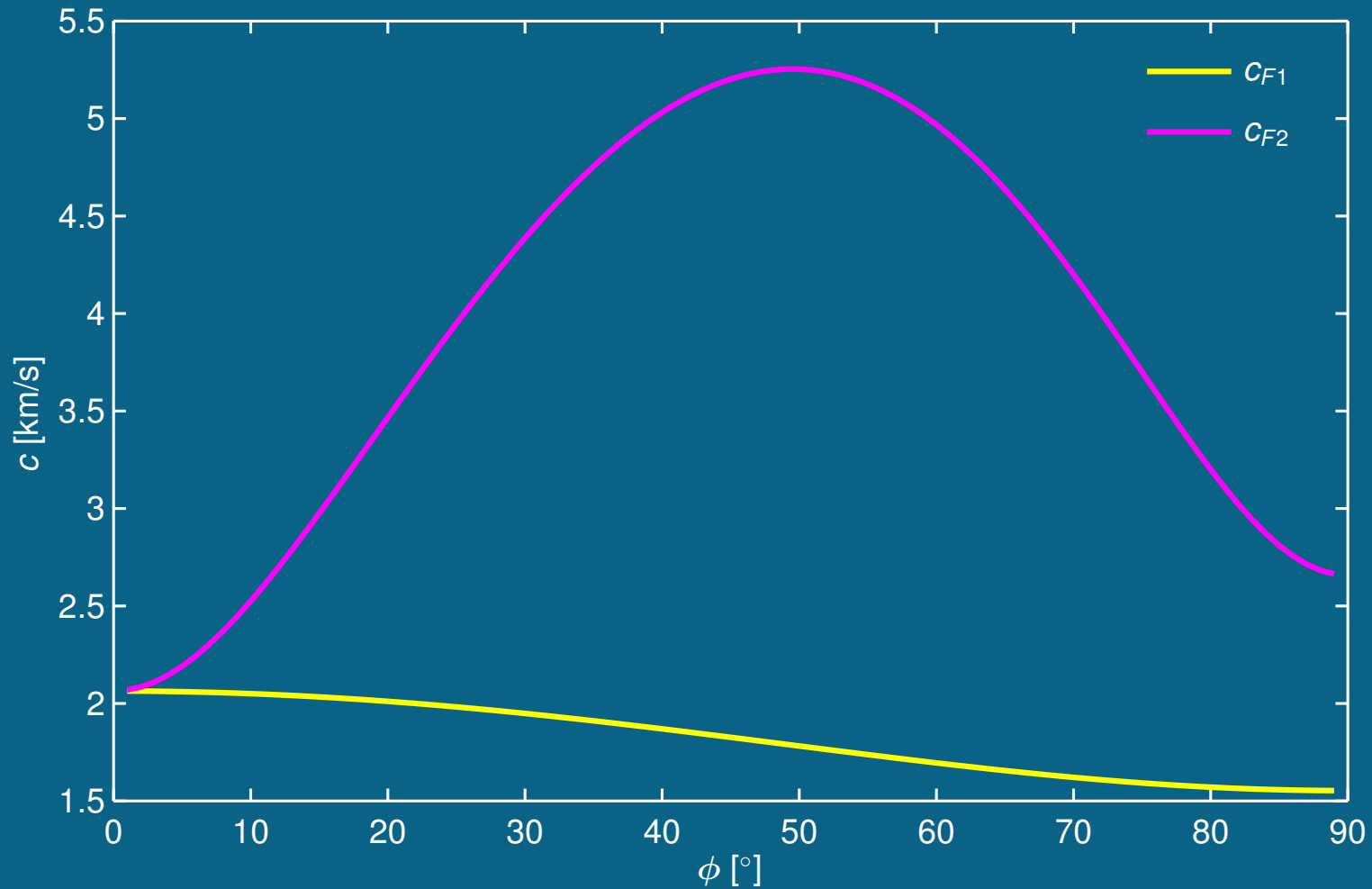
Průběhy parametrů A,B,C pro $\phi = 45^\circ$



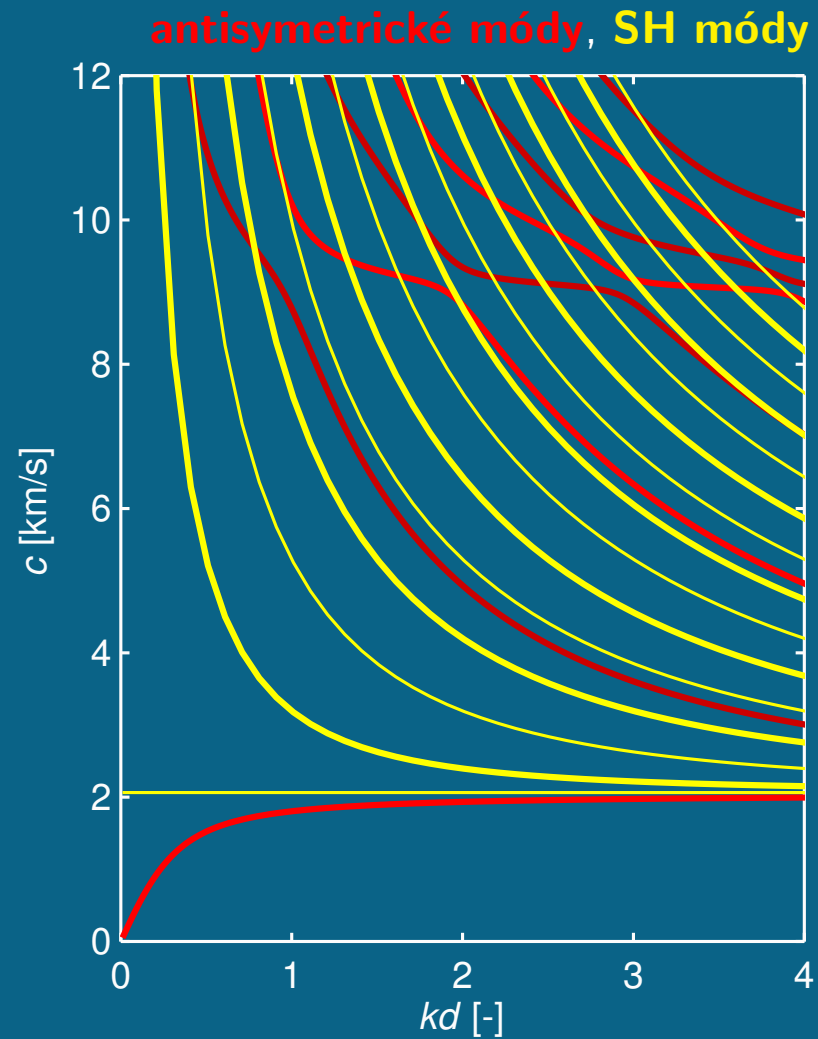
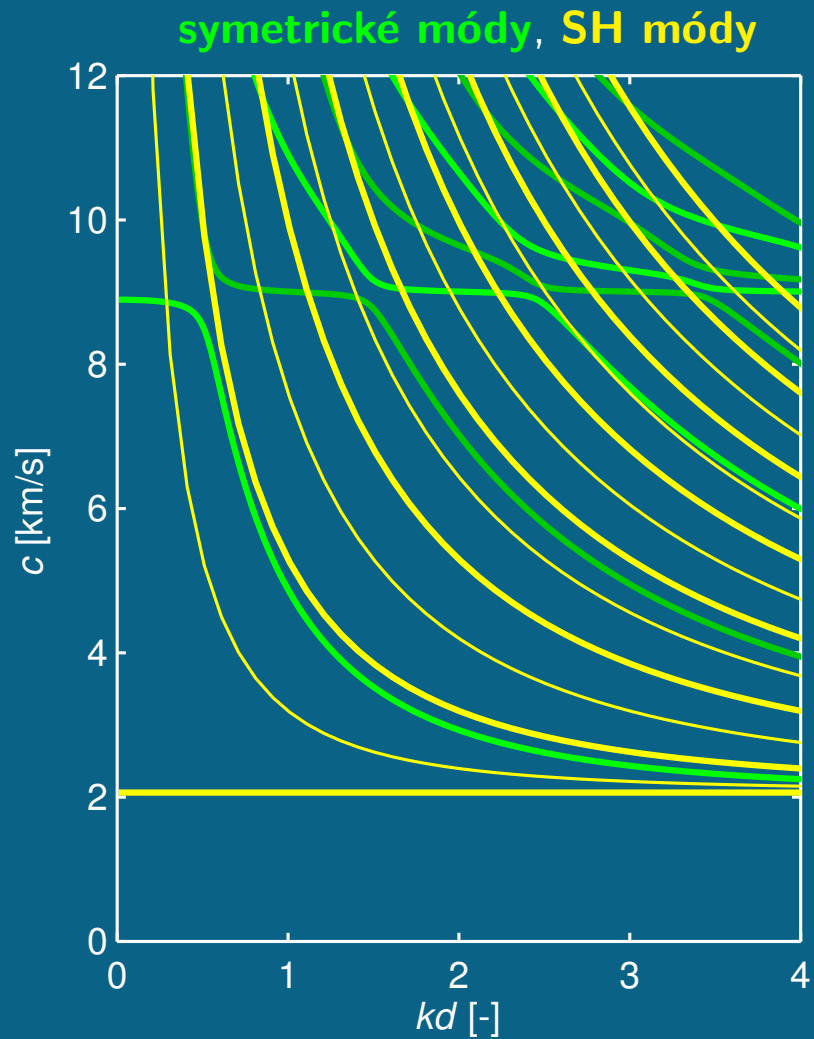
— reálná část

- - - imaginární část

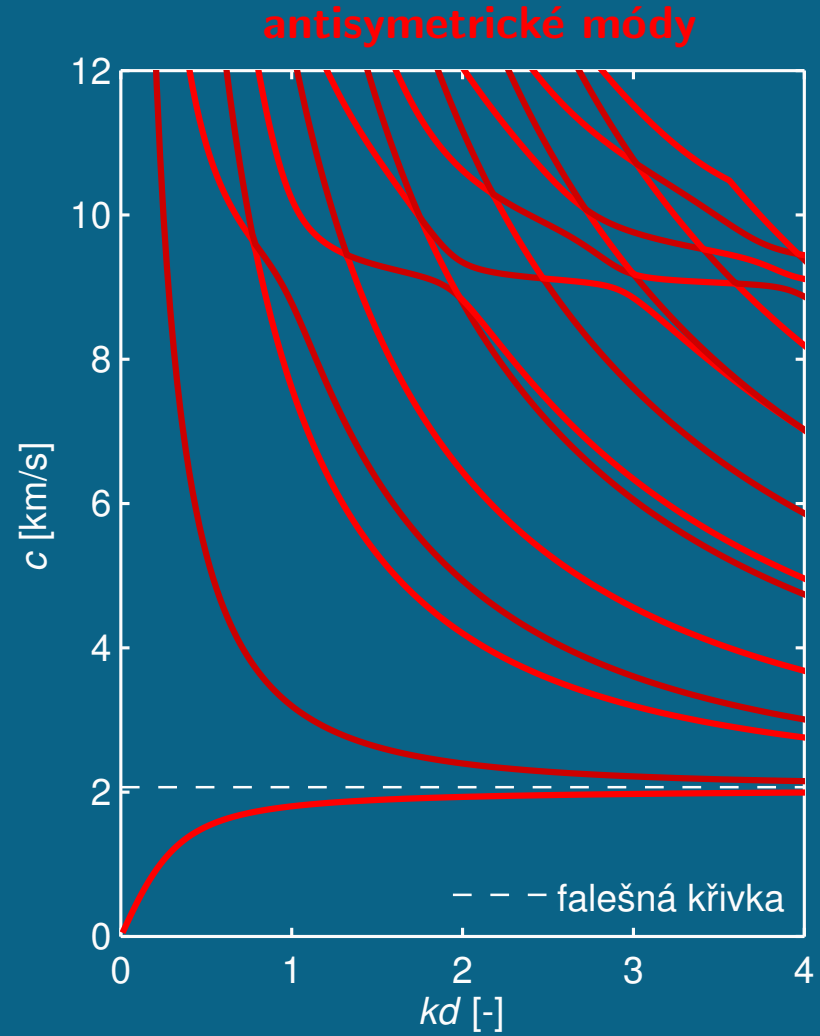
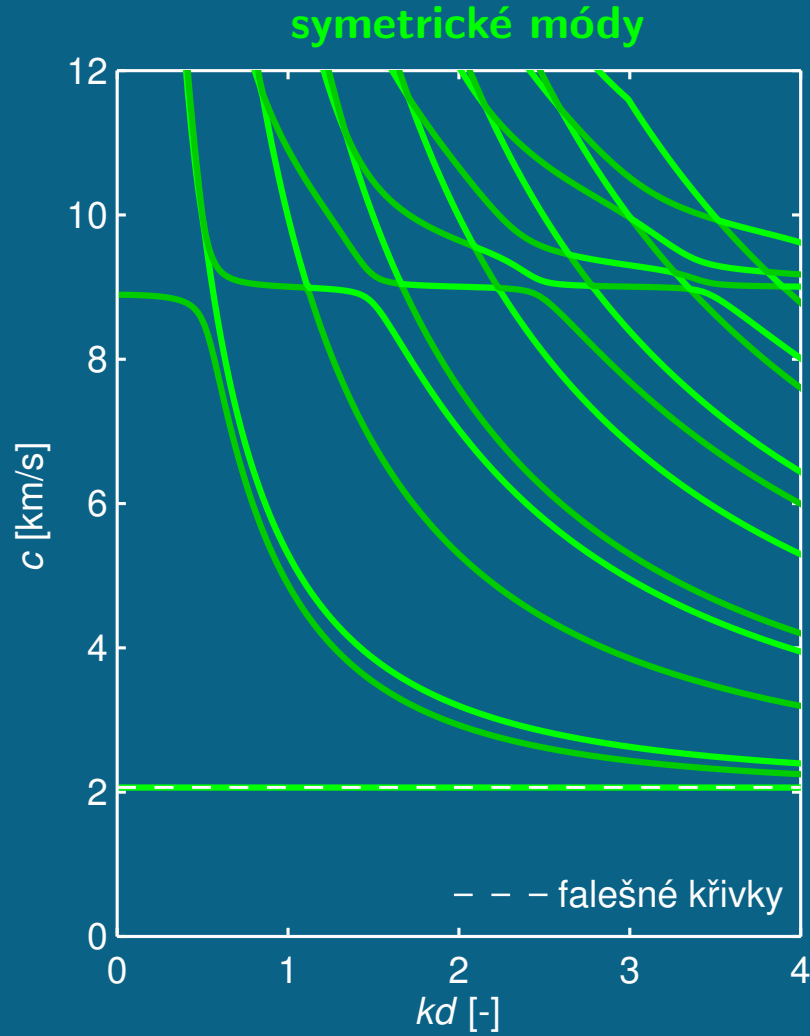
Závislost falešných kořenů (rychlostí) na směru šíření ϕ



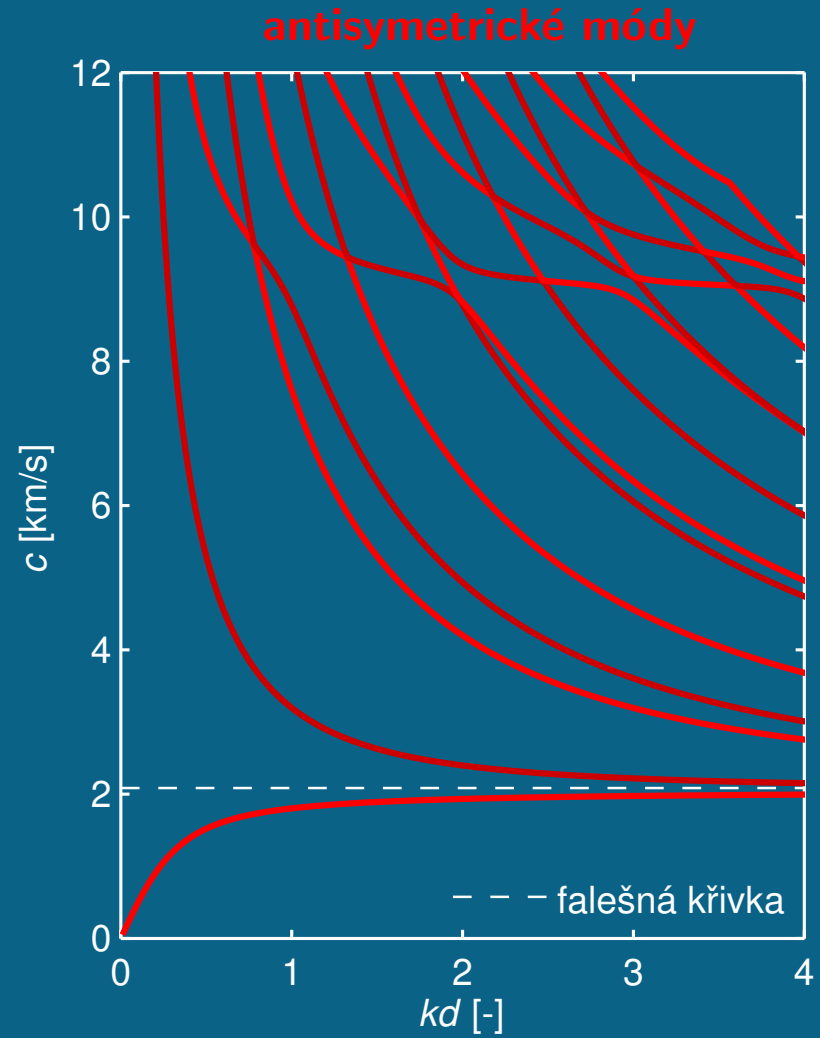
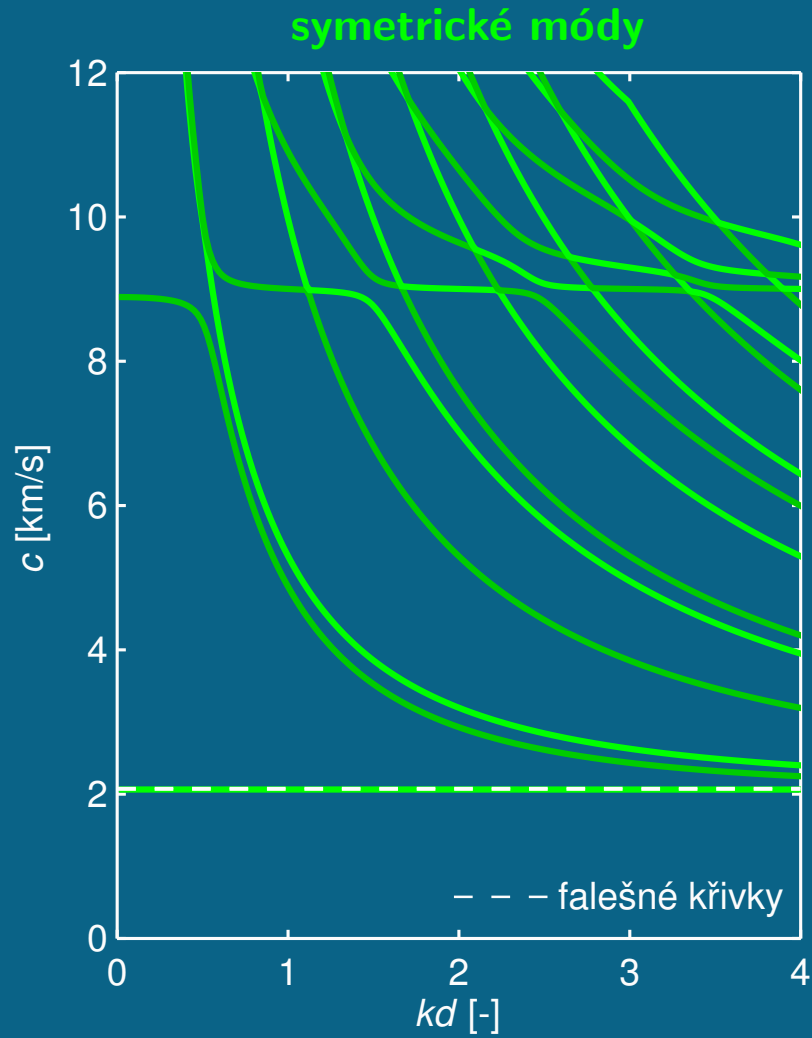
Směr šíření $\phi = 0^\circ$



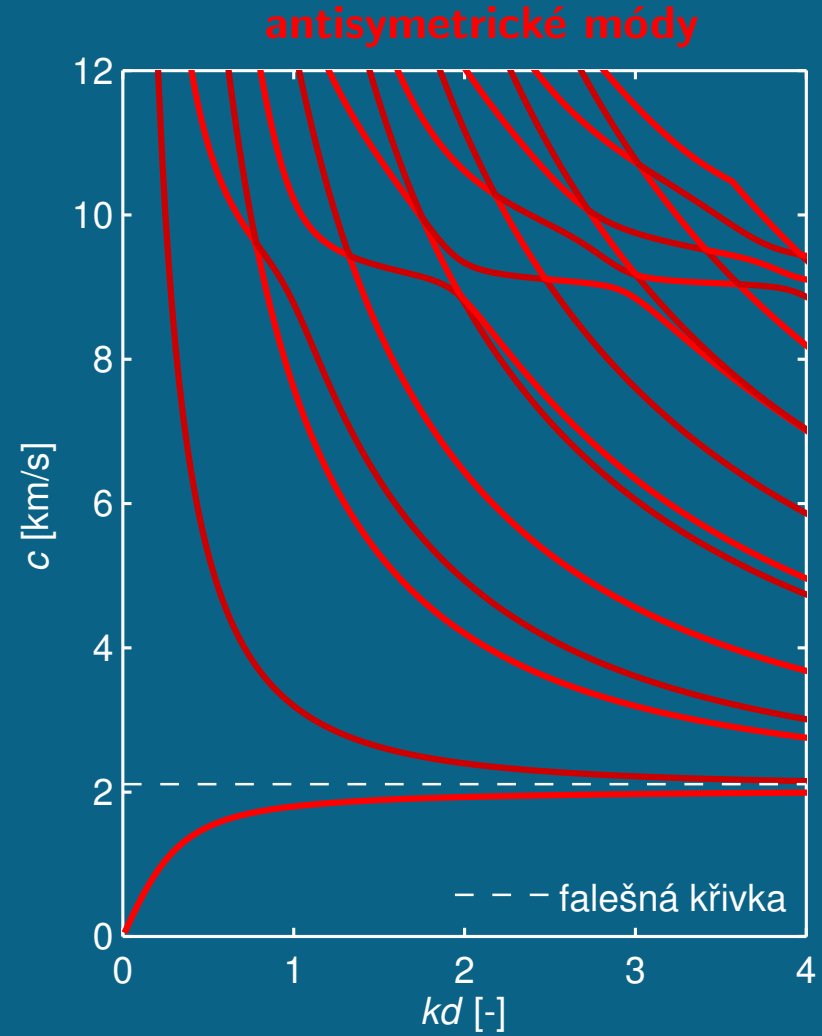
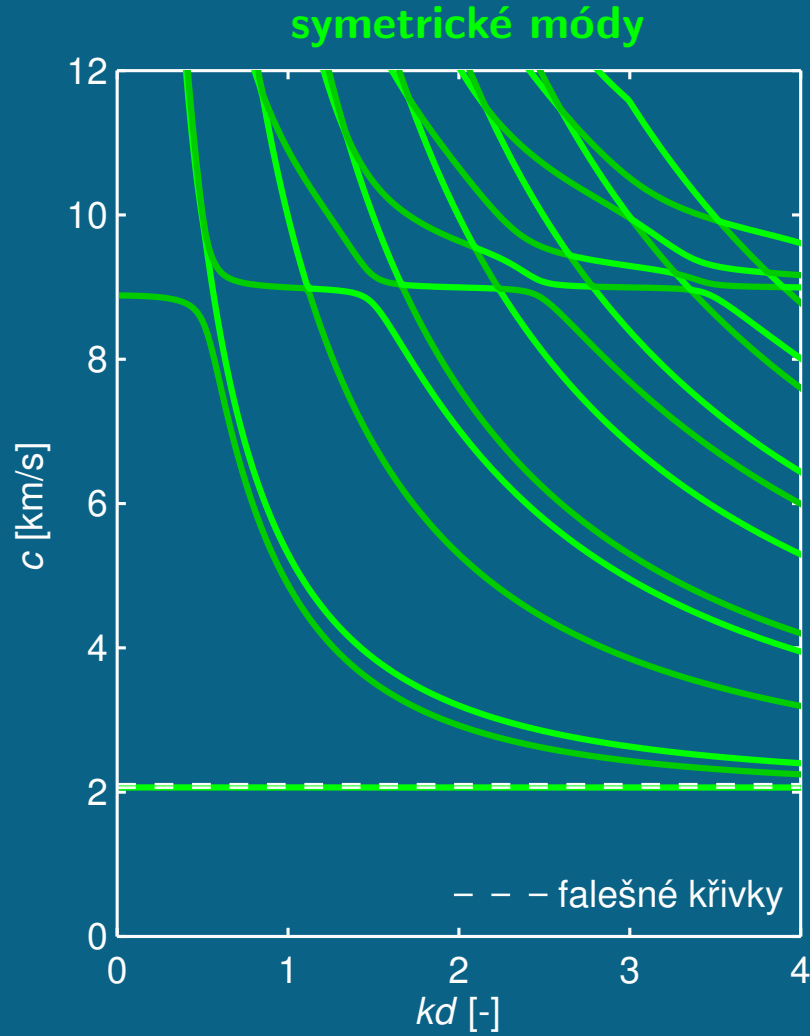
Směr šíření $\phi = 1^\circ$



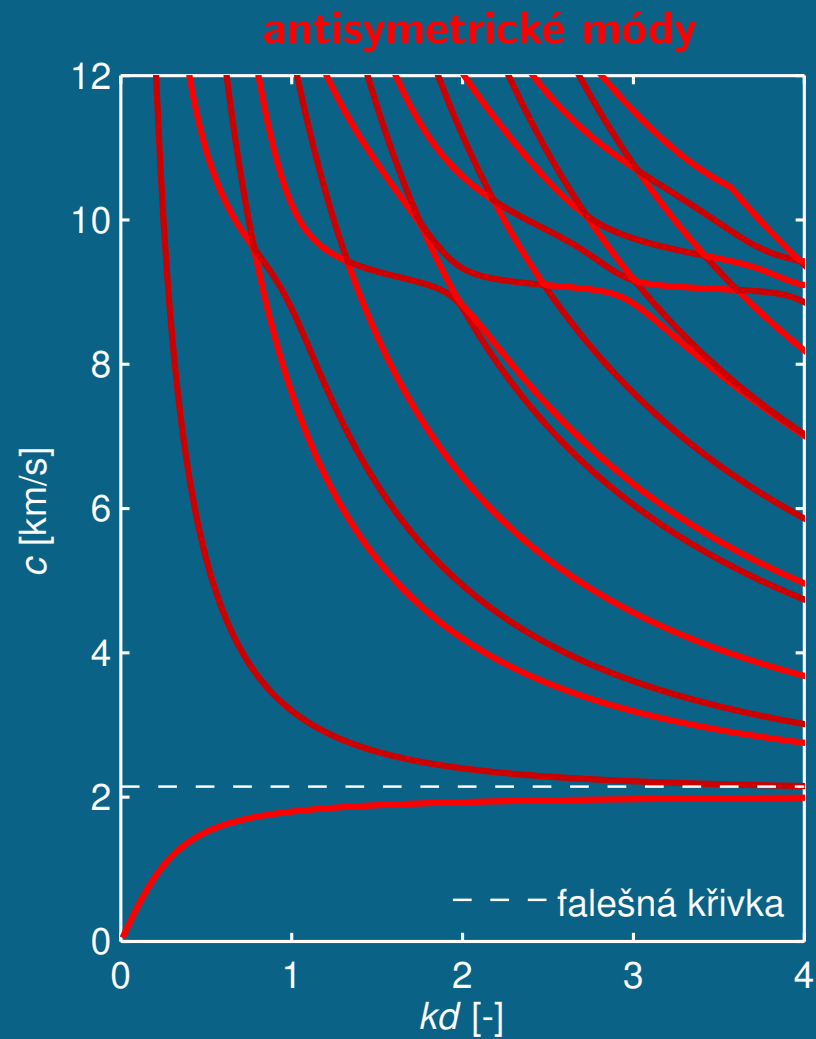
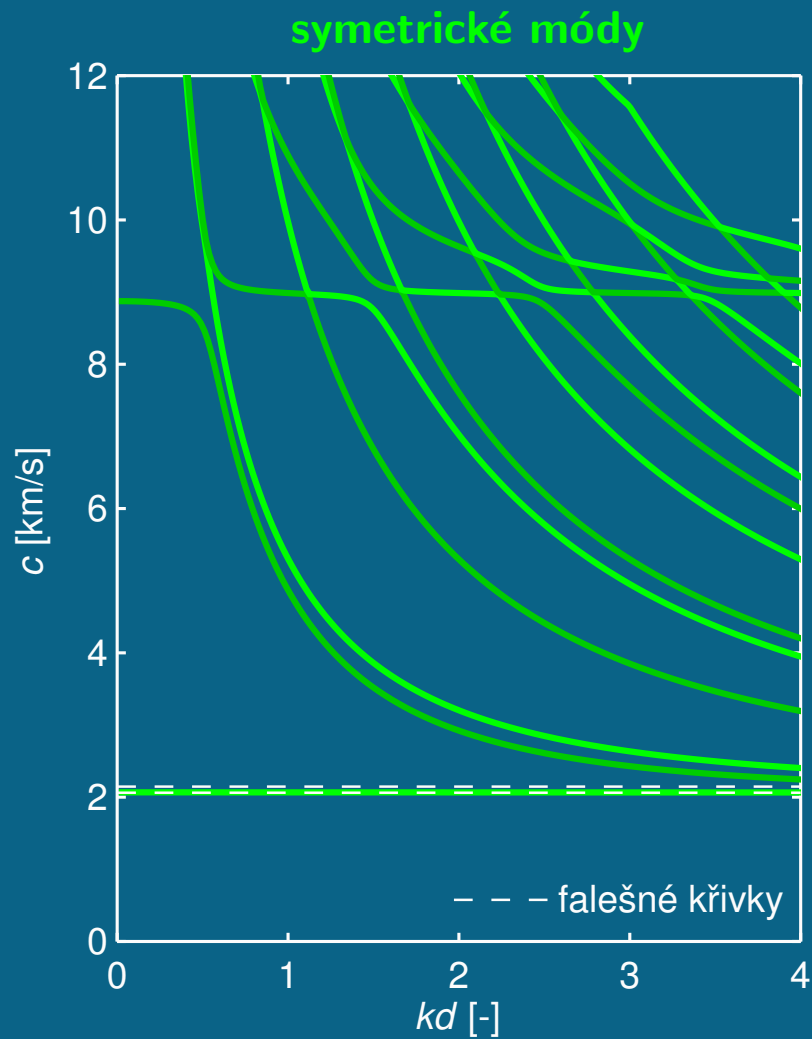
Směr šíření $\phi = 2^\circ$



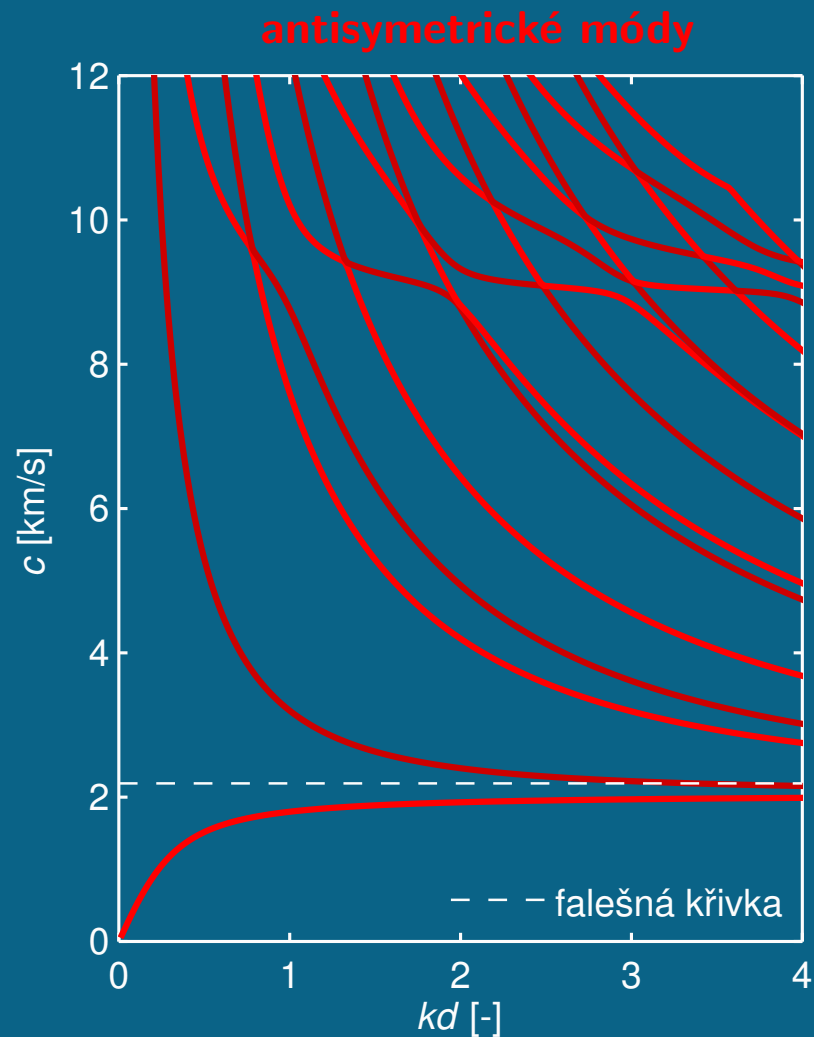
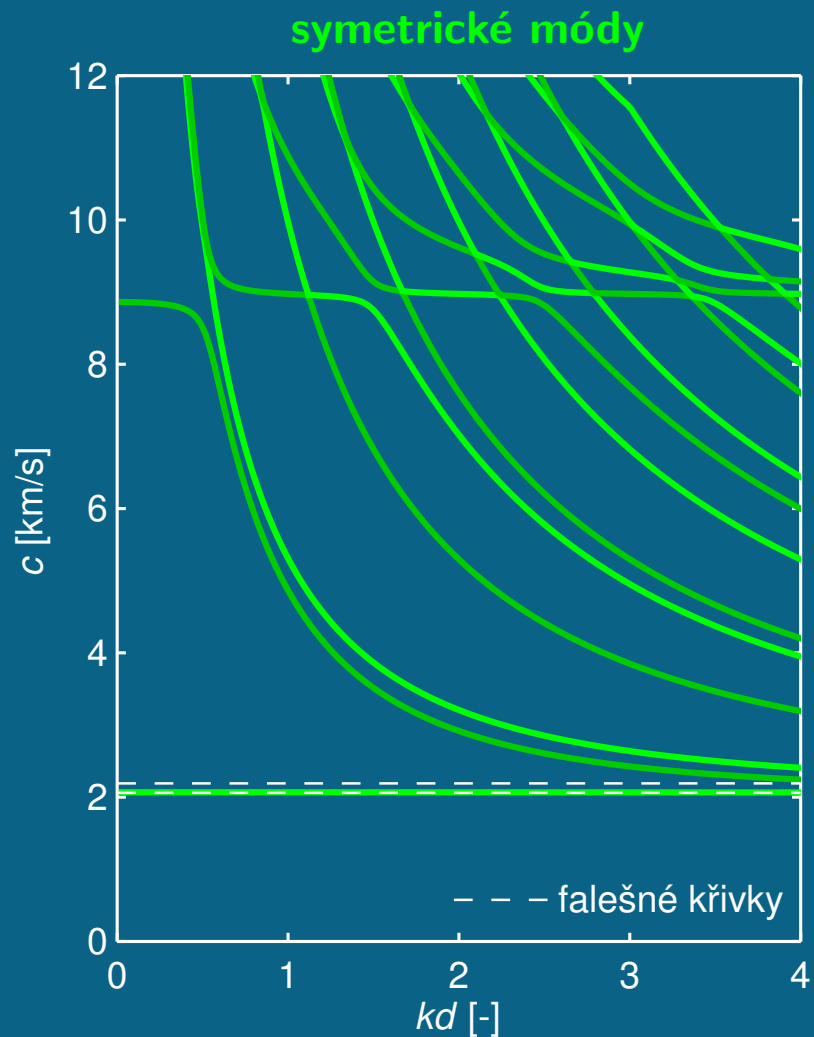
Směr šíření $\phi = 3^\circ$



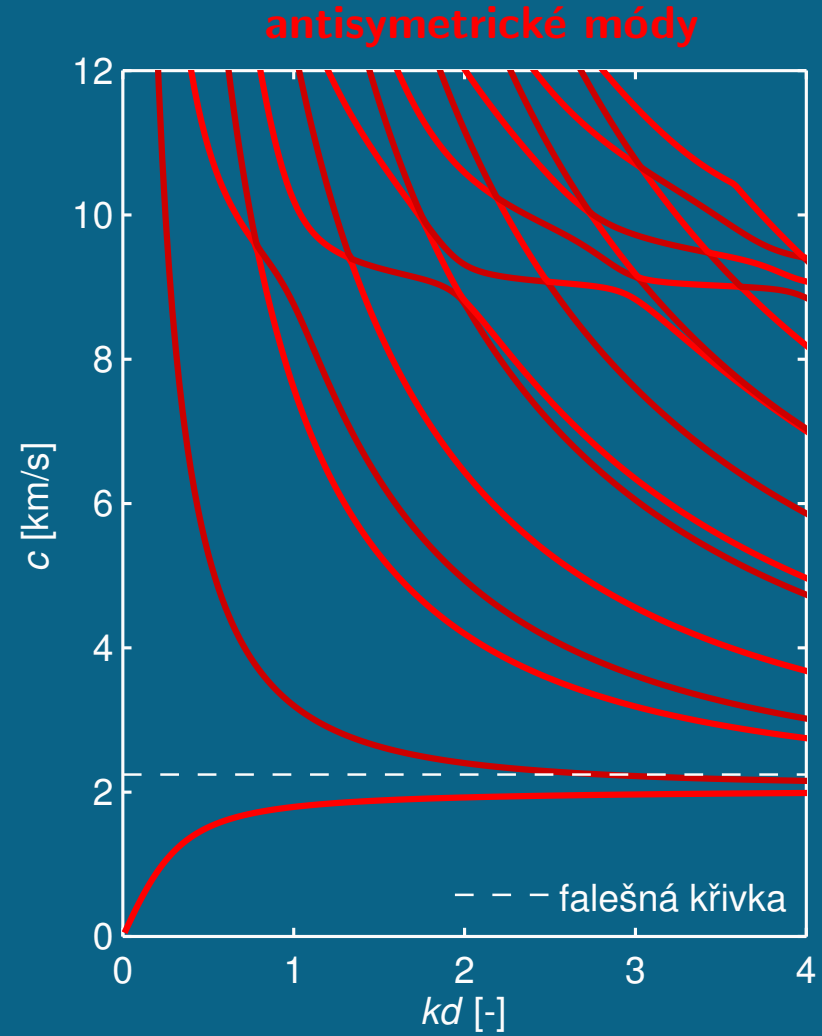
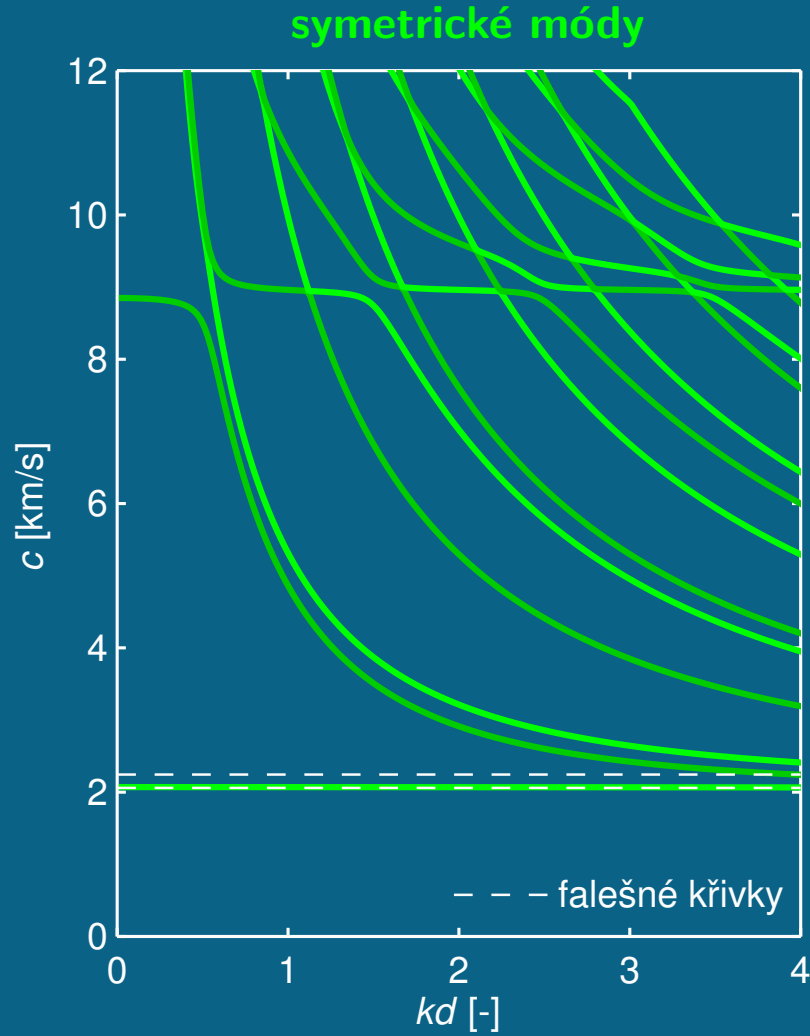
Směr šíření $\phi = 4^\circ$



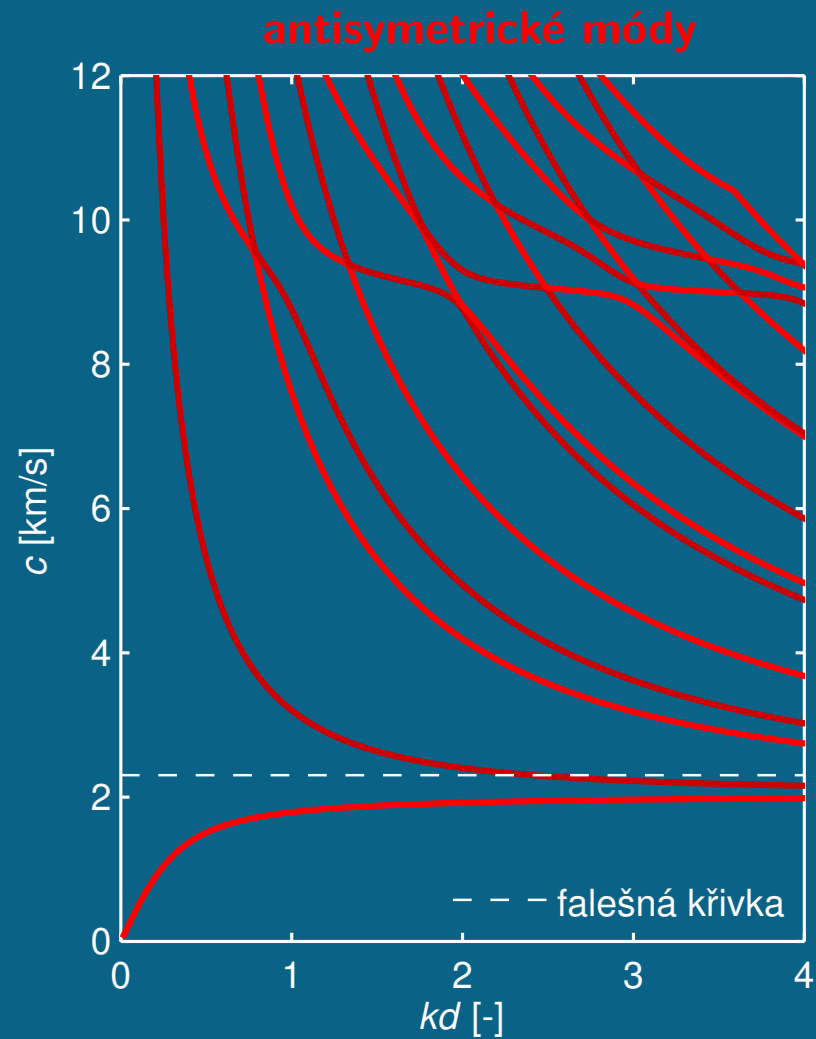
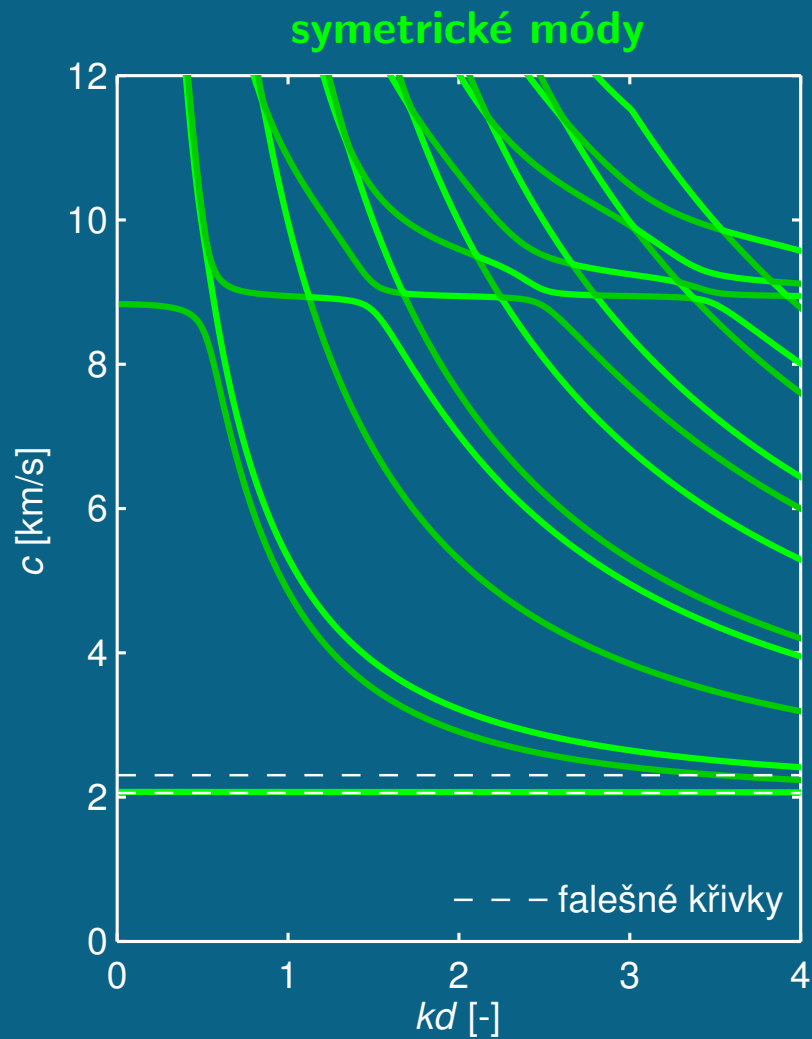
Směr šíření $\phi = 5^\circ$



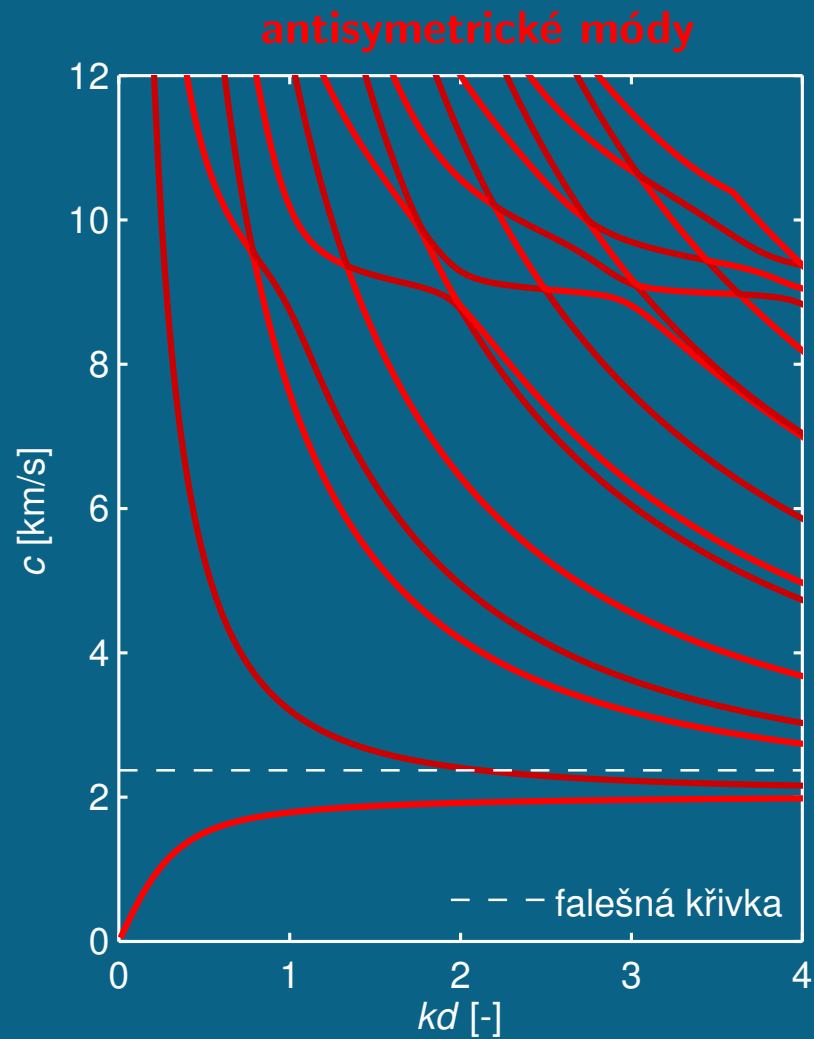
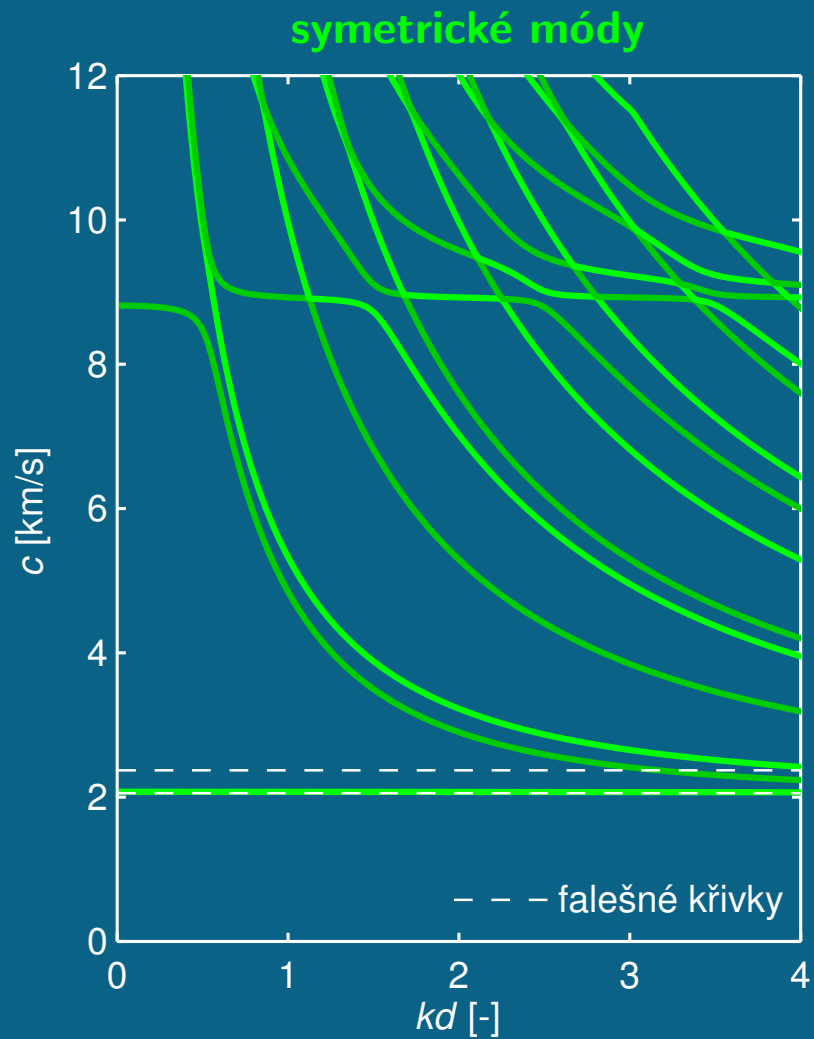
Směr šíření $\phi = 6^\circ$



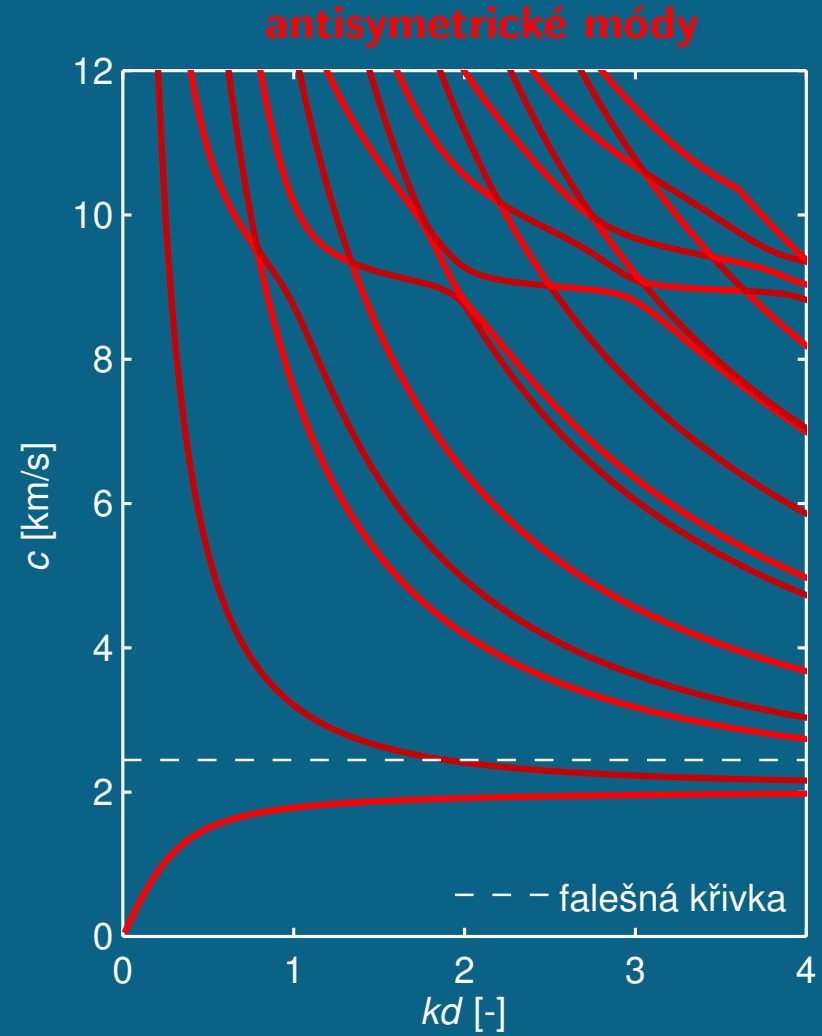
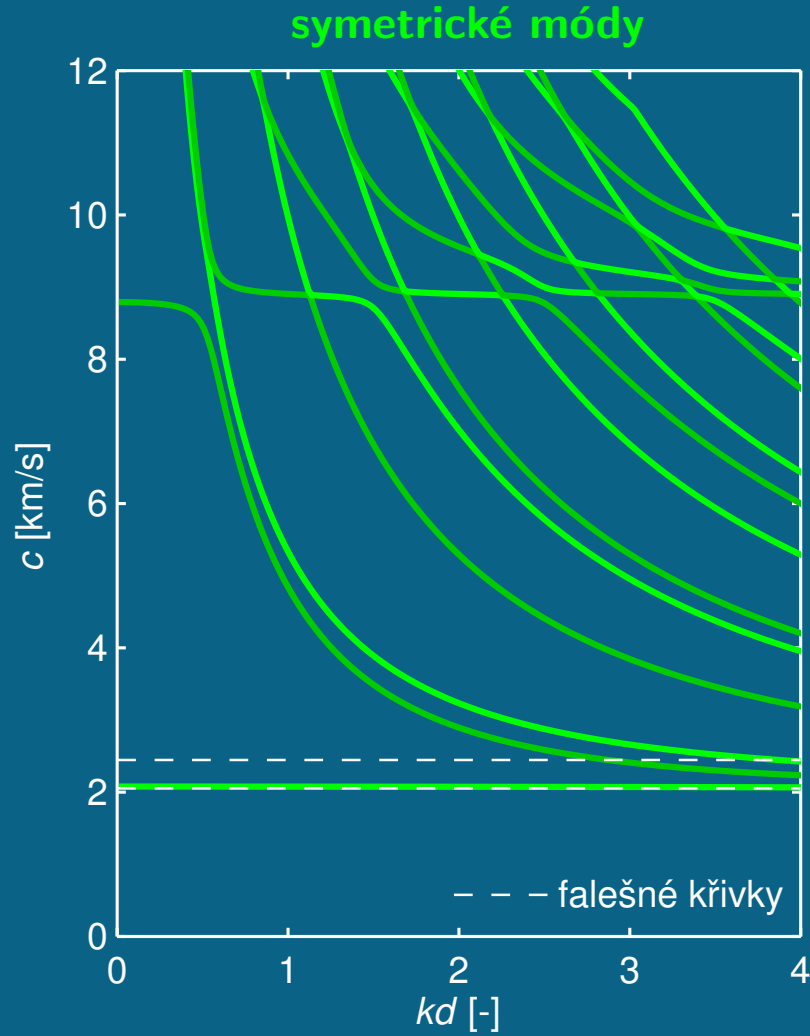
Směr šíření $\phi = 7^\circ$



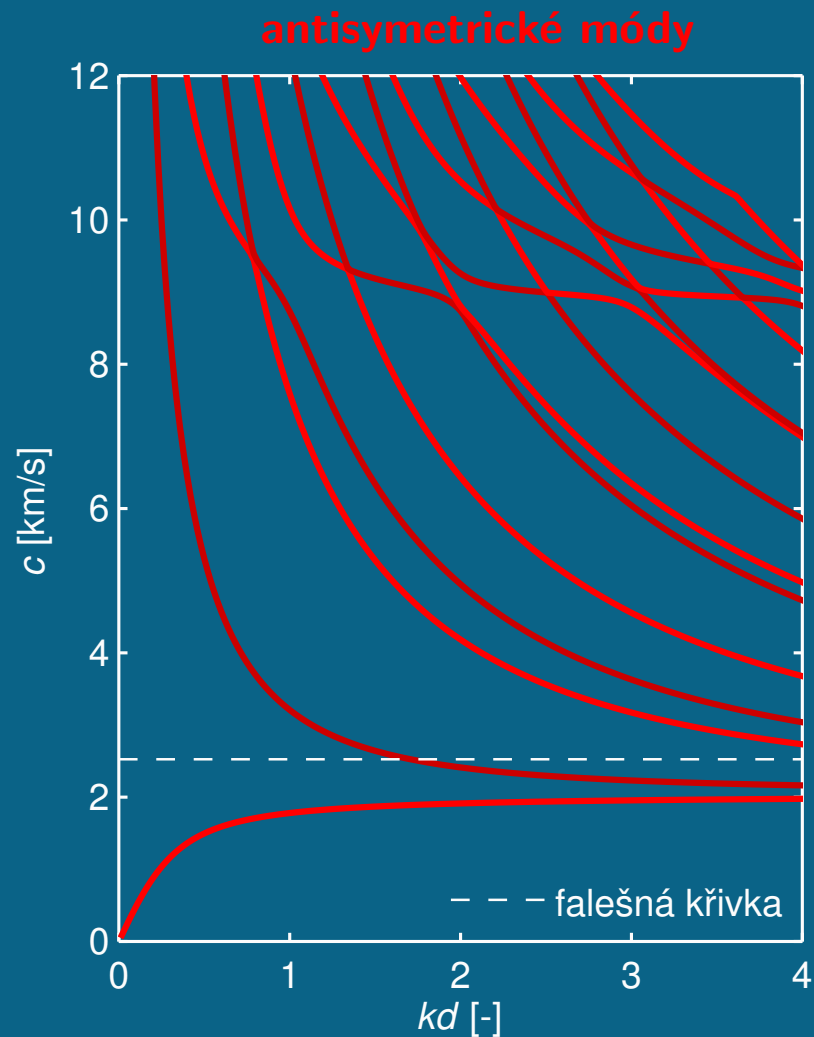
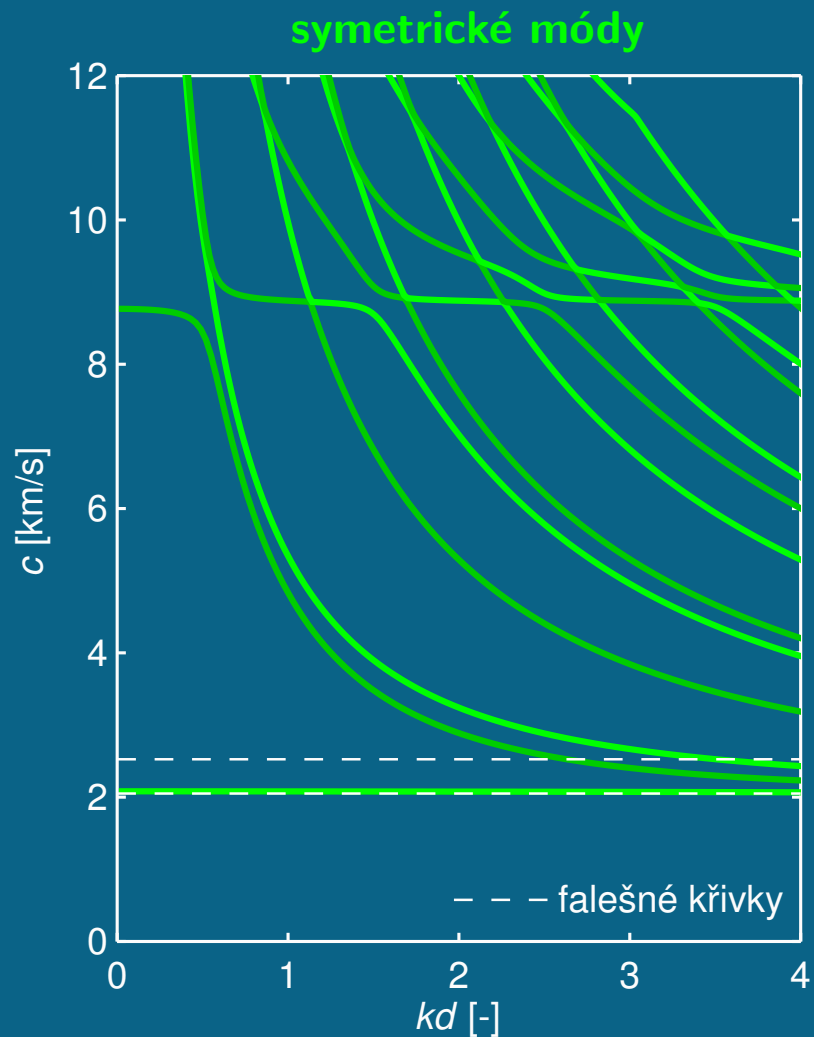
Směr šíření $\phi = 8^\circ$



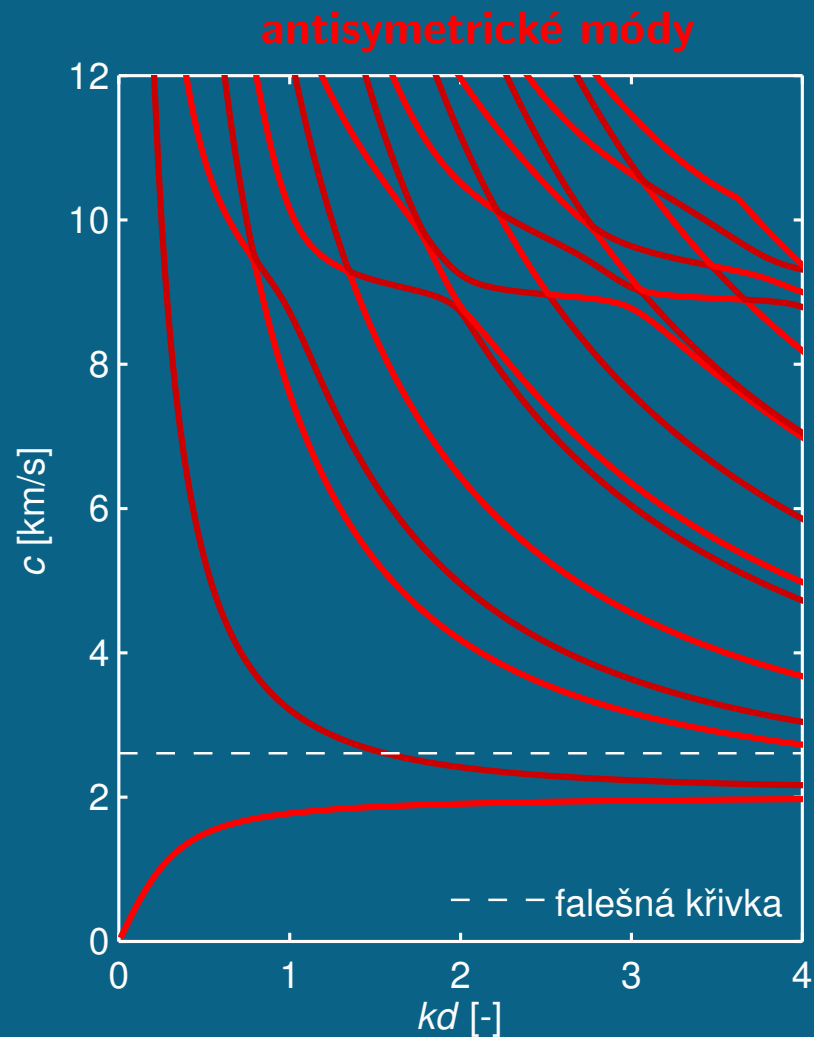
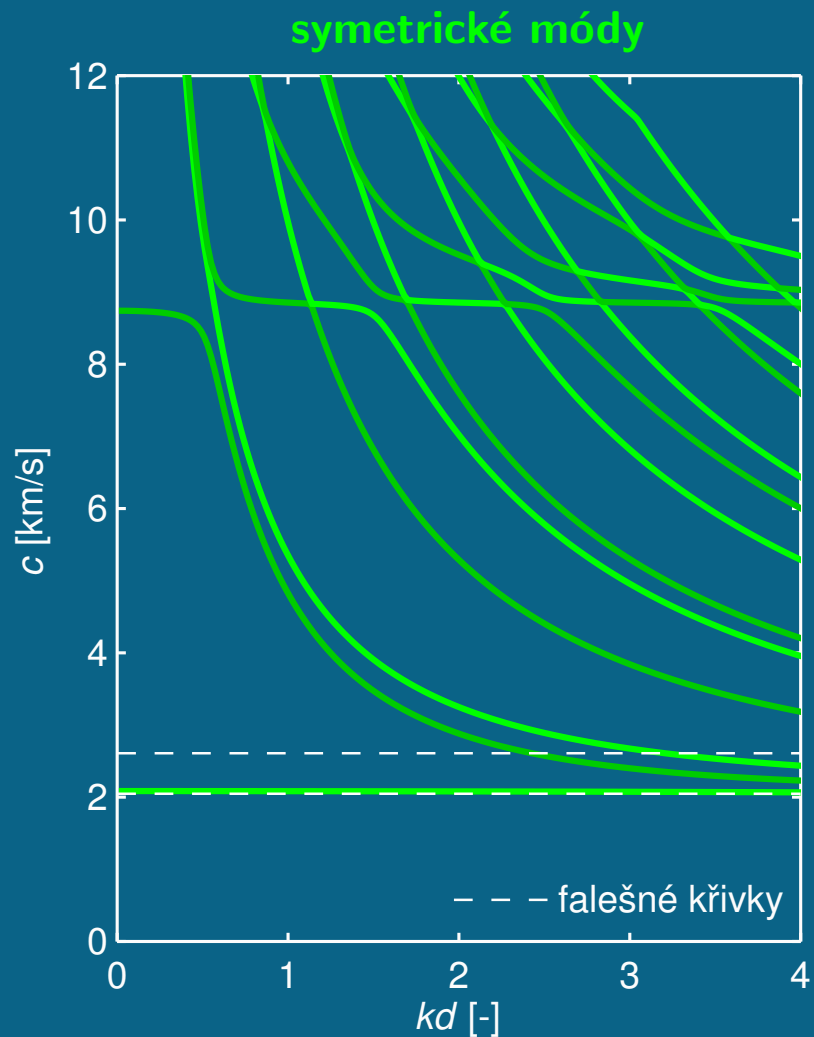
Směr šíření $\phi = 9^\circ$



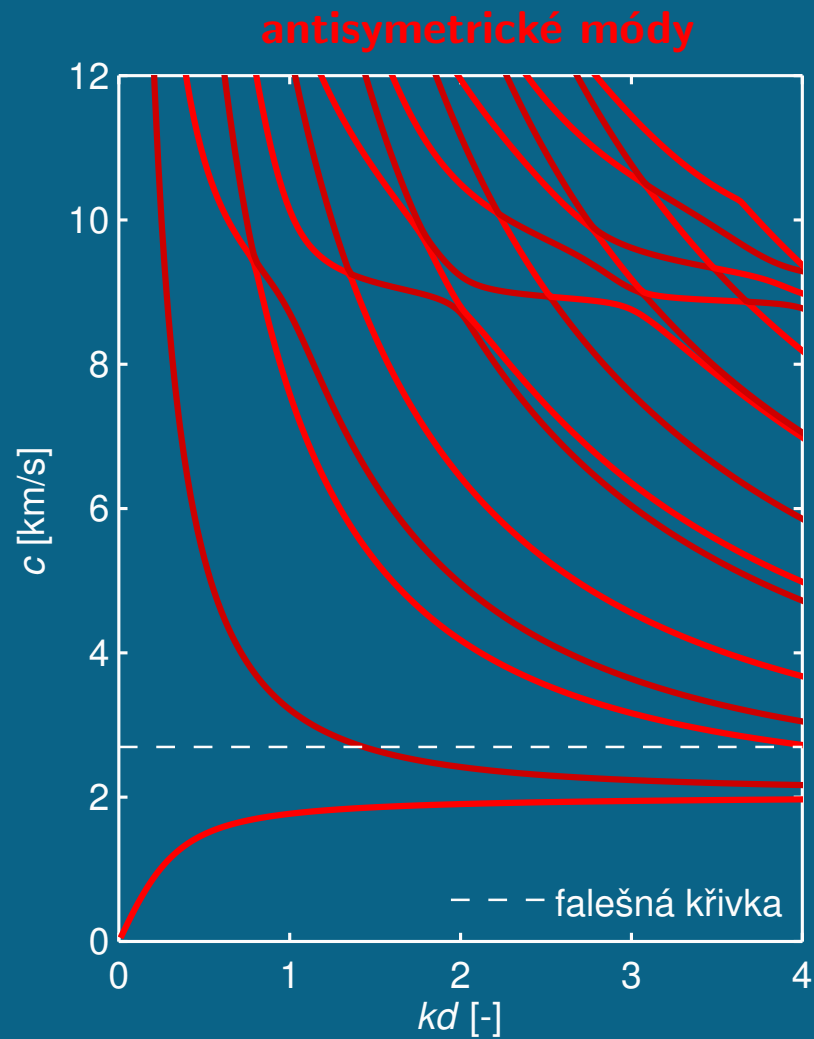
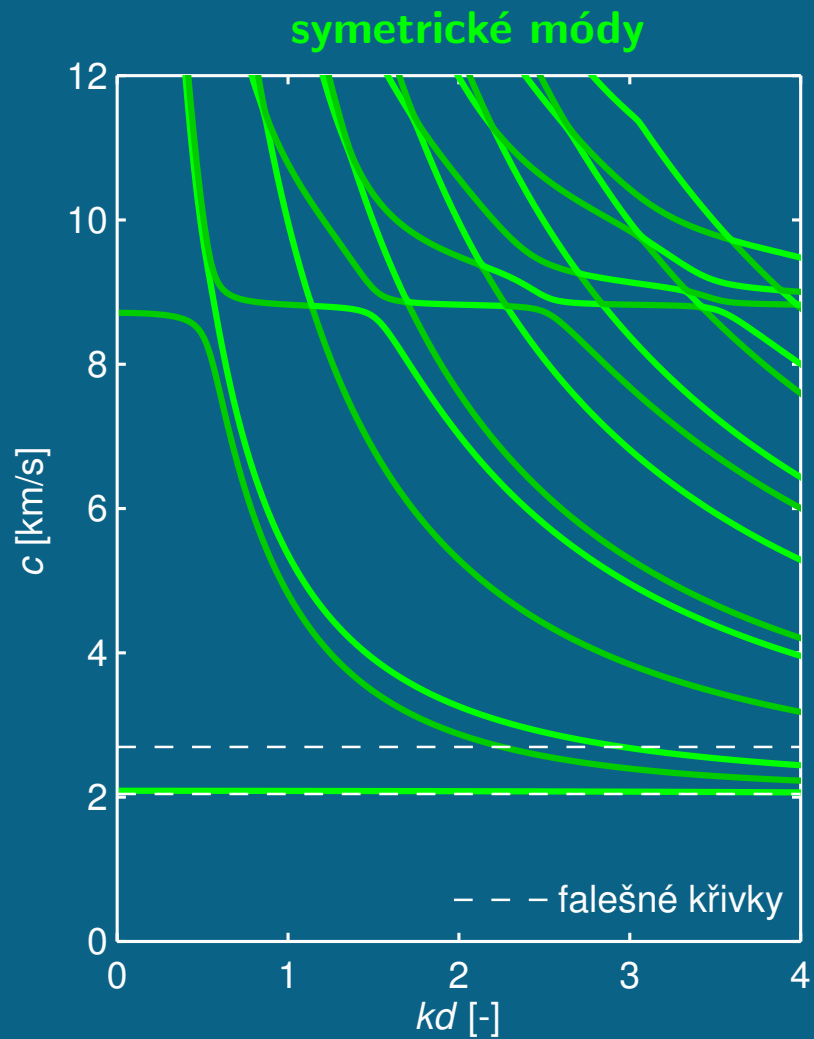
Směr šíření $\phi = 10^\circ$



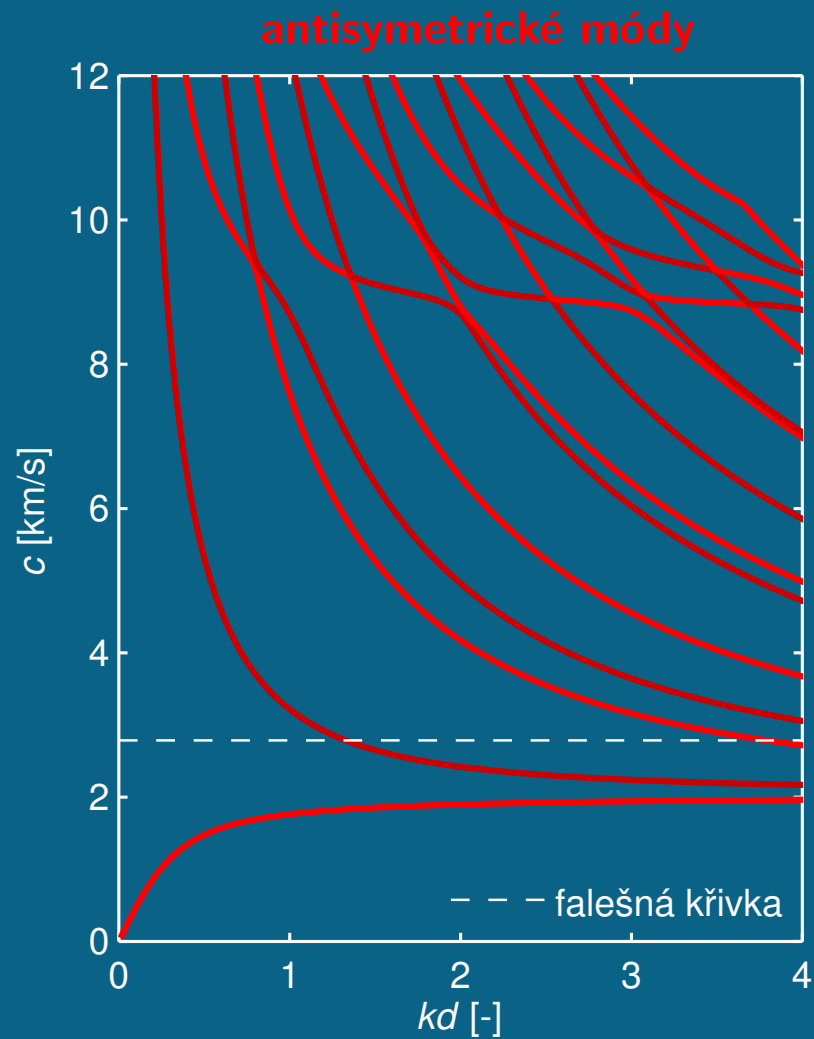
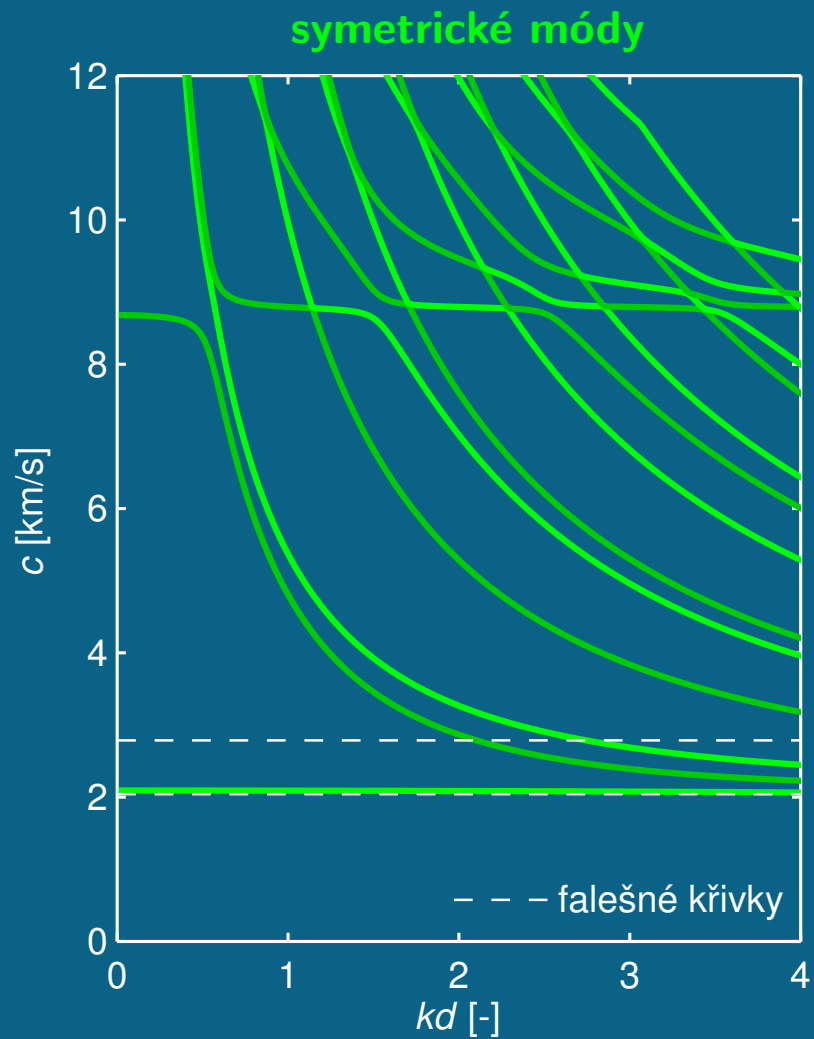
Směr šíření $\phi = 11^\circ$



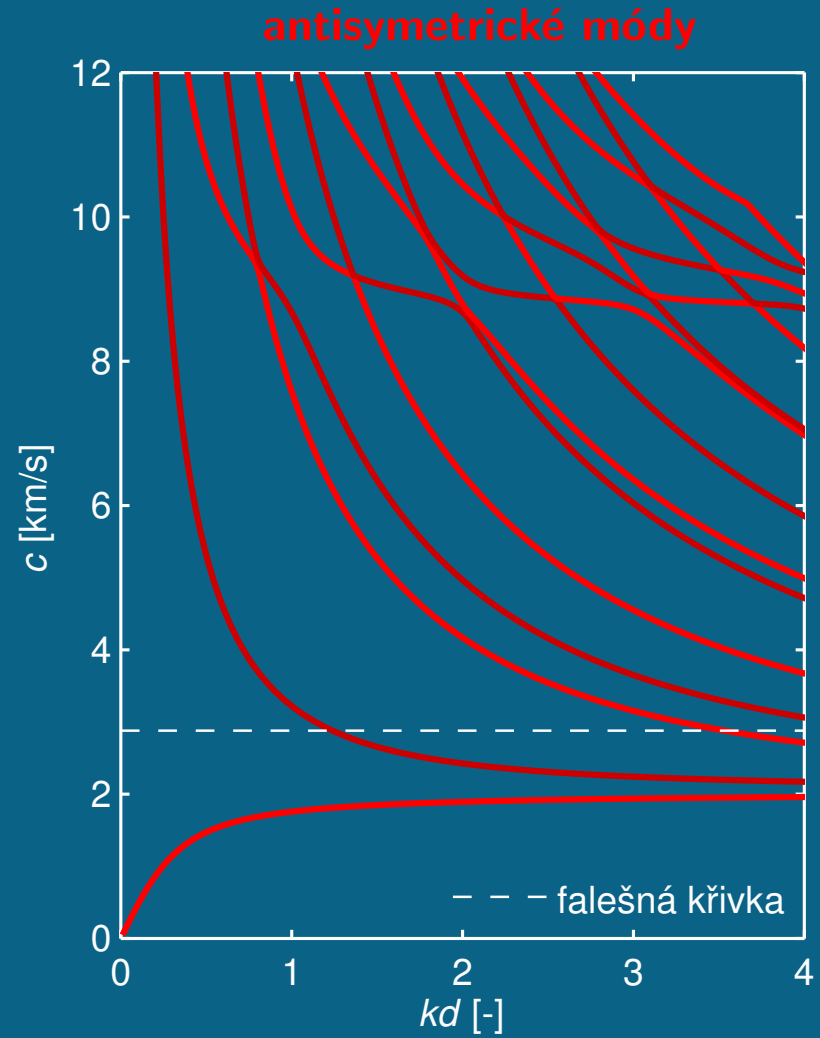
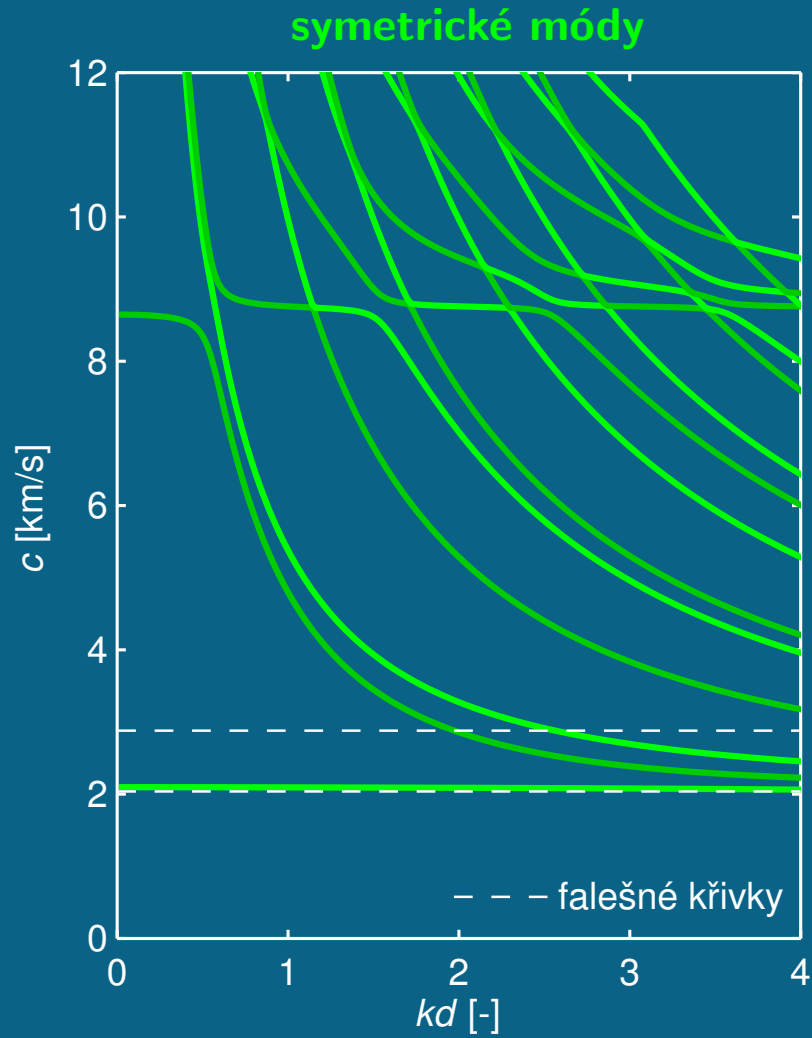
Směr šíření $\phi = 12^\circ$



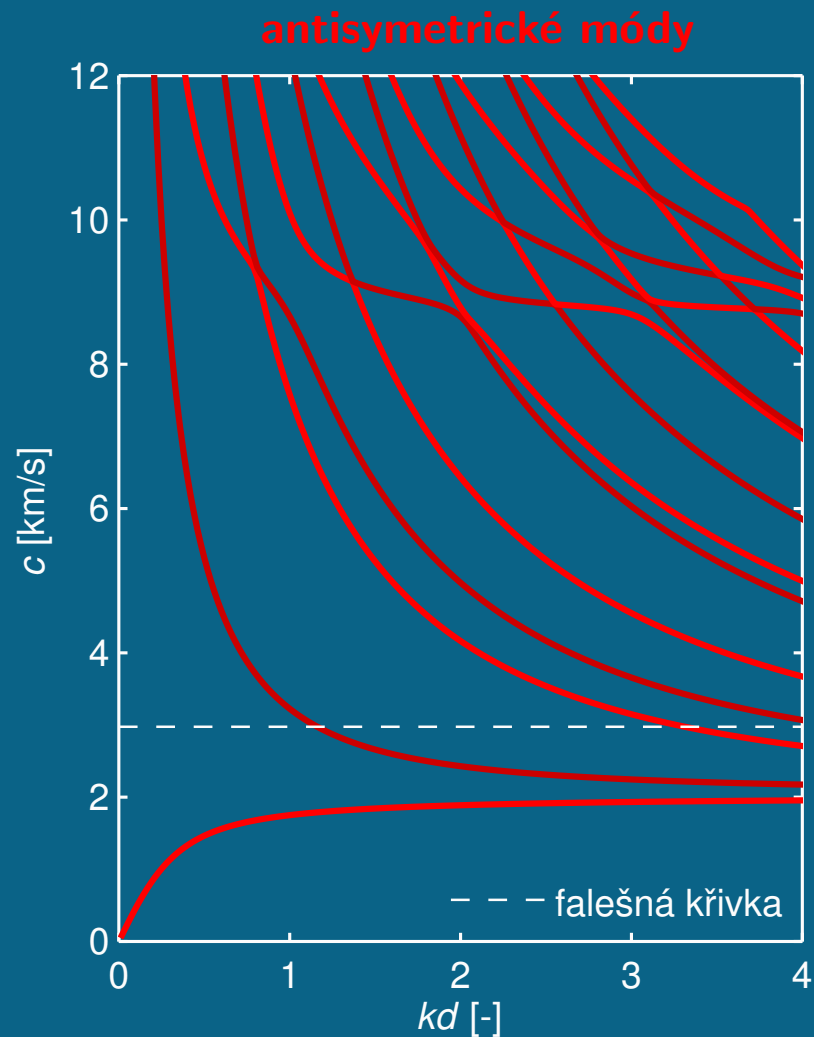
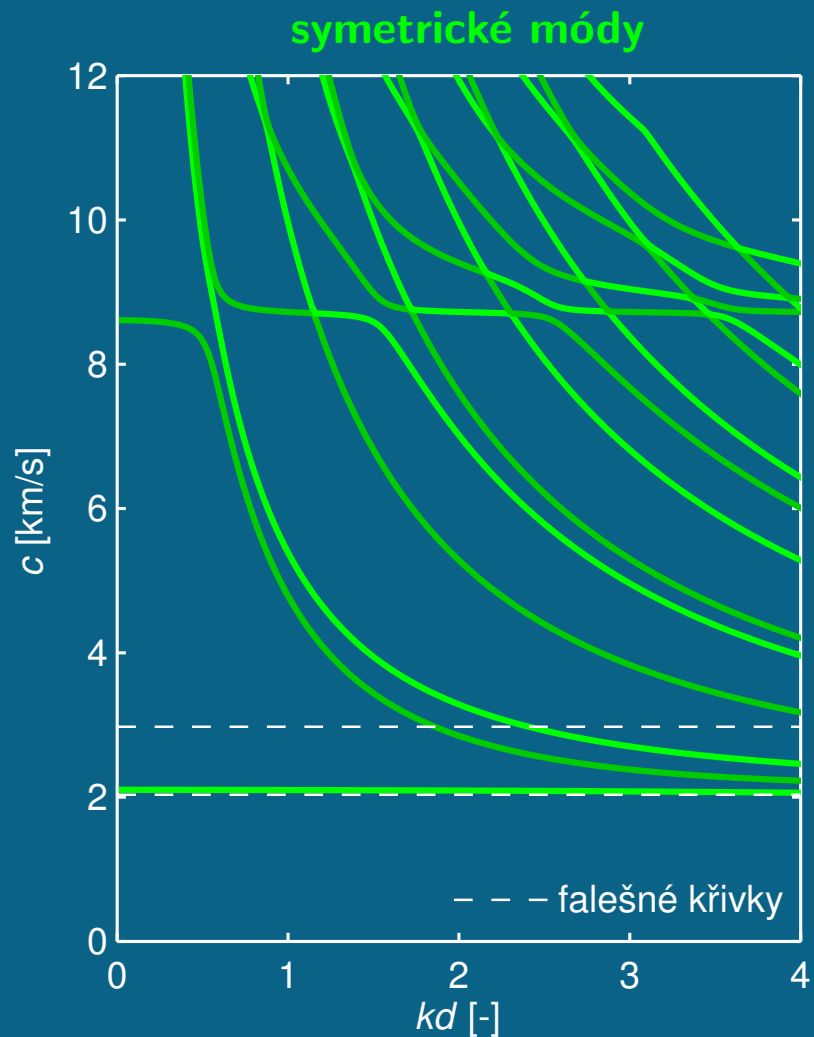
Směr šíření $\phi = 13^\circ$



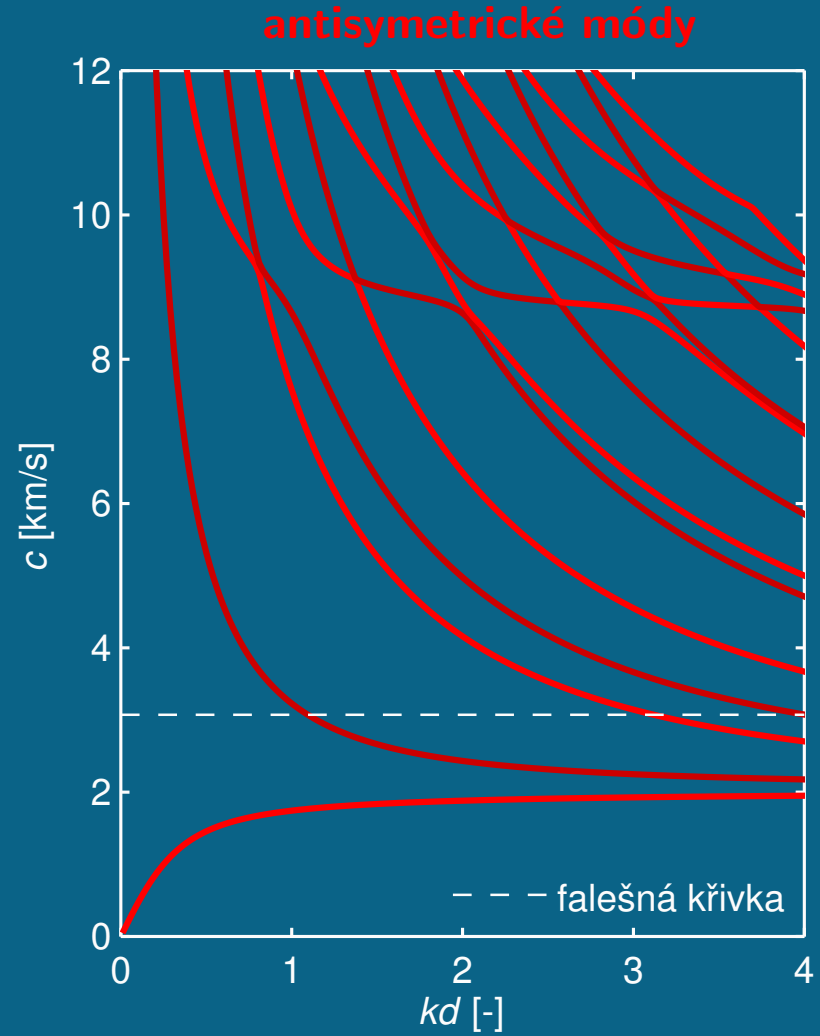
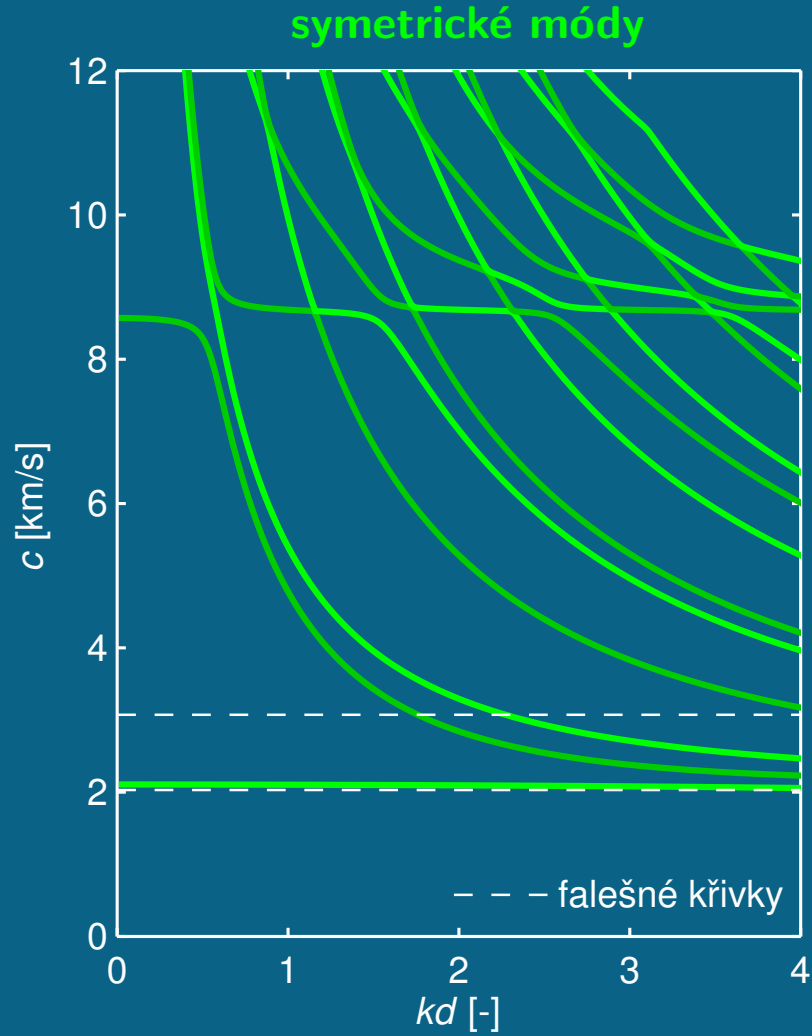
Směr šíření $\phi = 14^\circ$



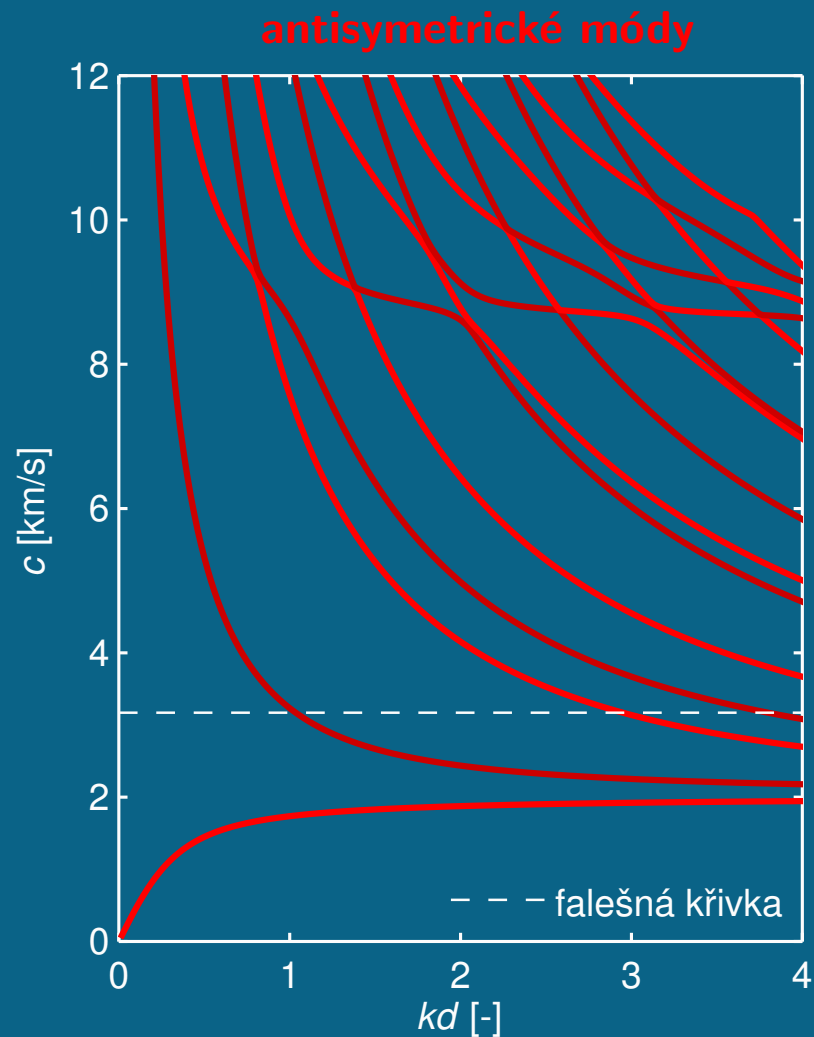
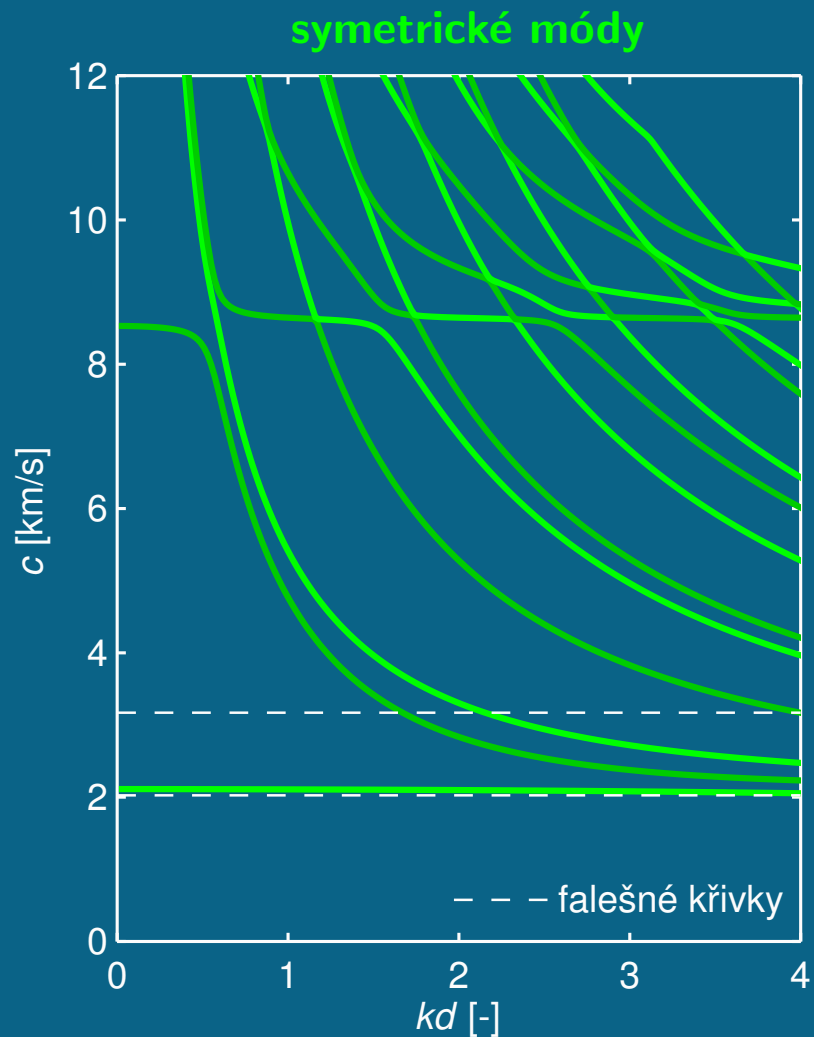
Směr šíření $\phi = 15^\circ$



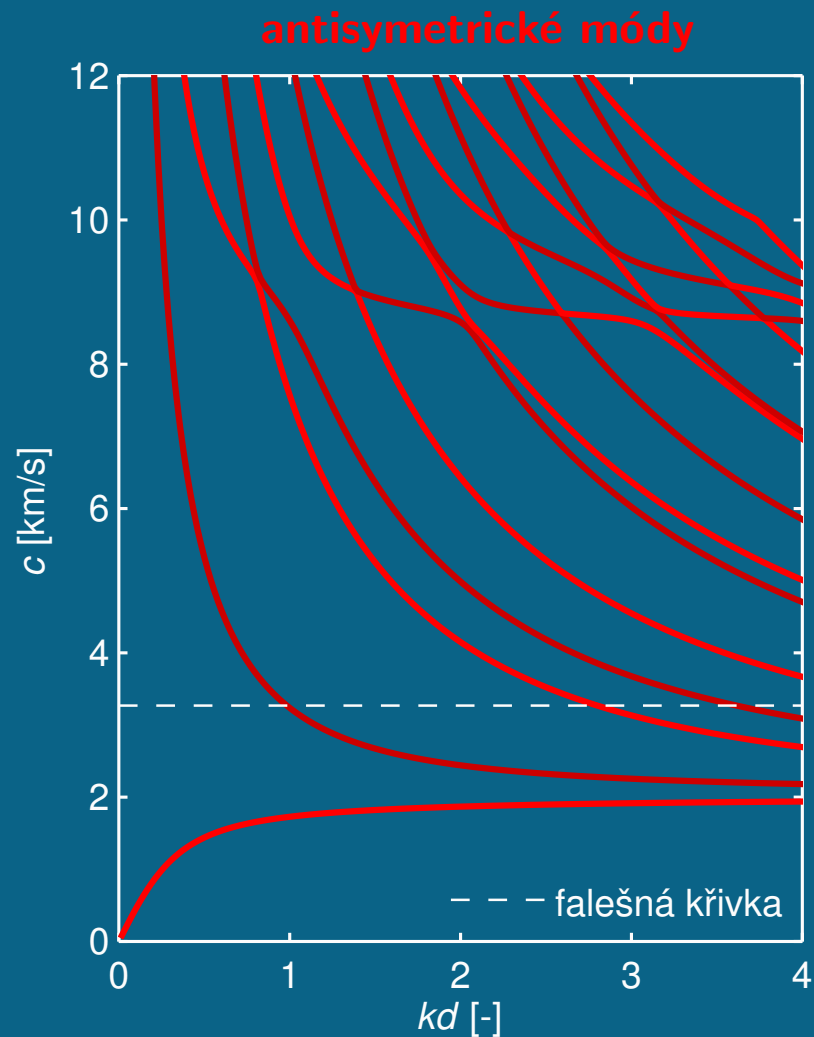
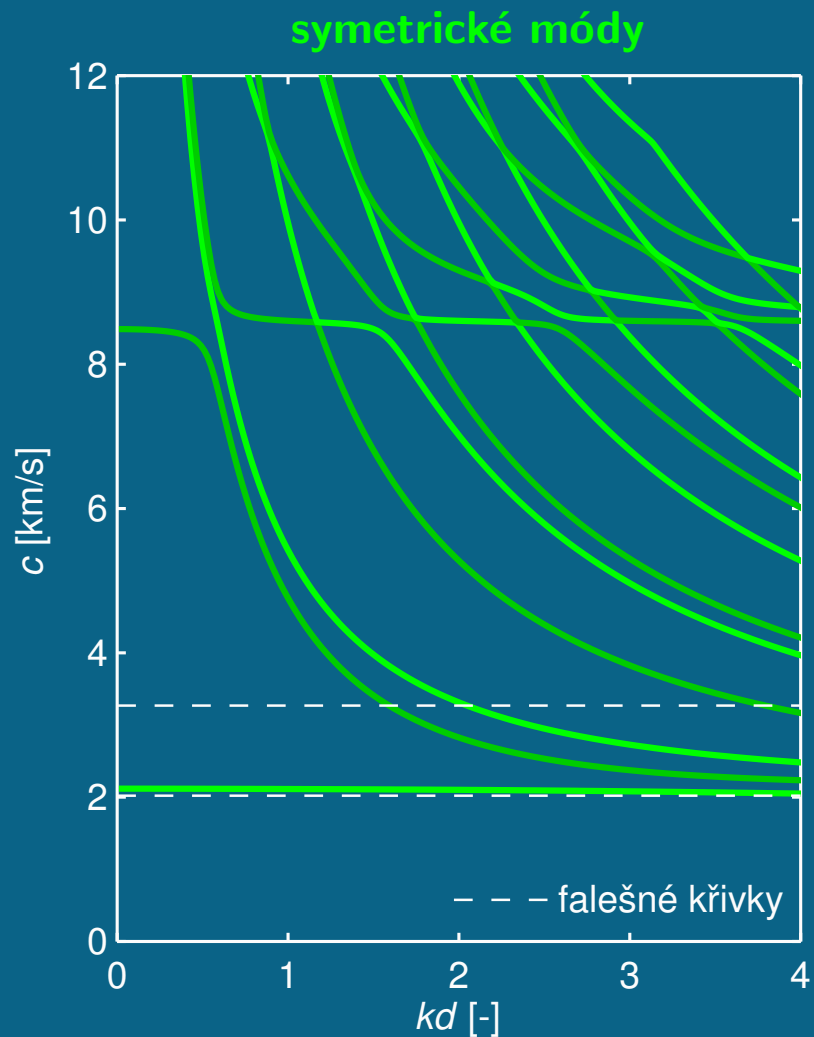
Směr šíření $\phi = 16^\circ$



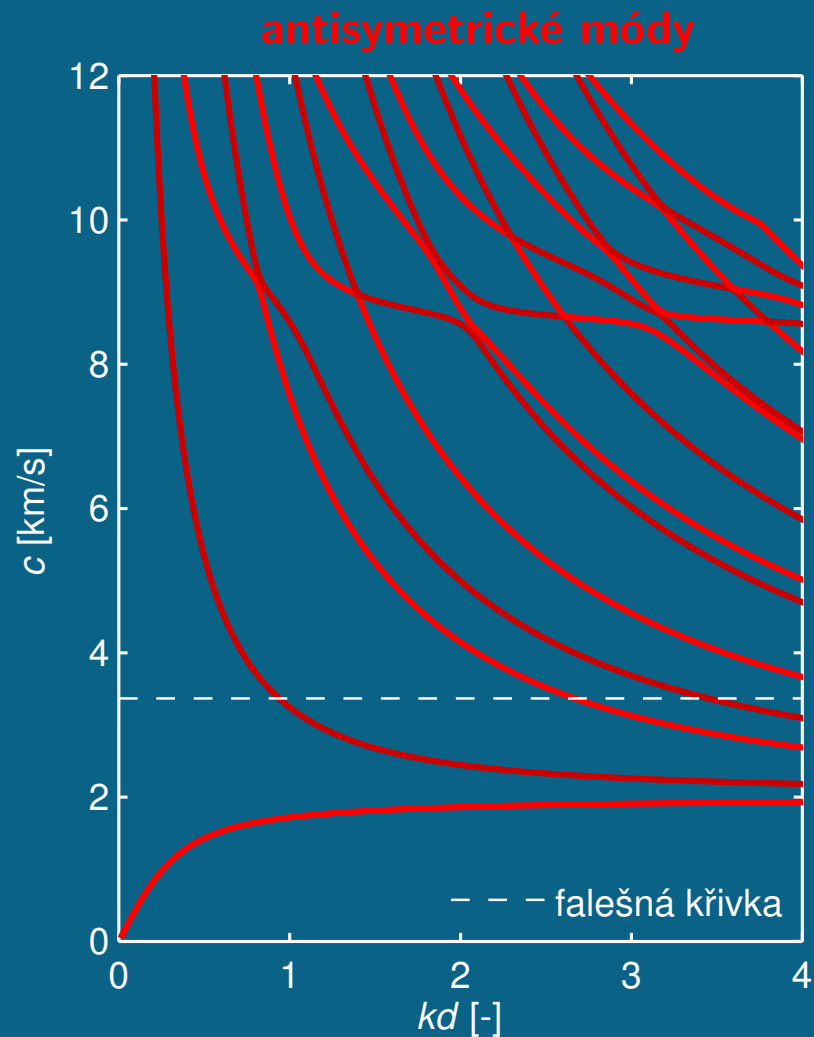
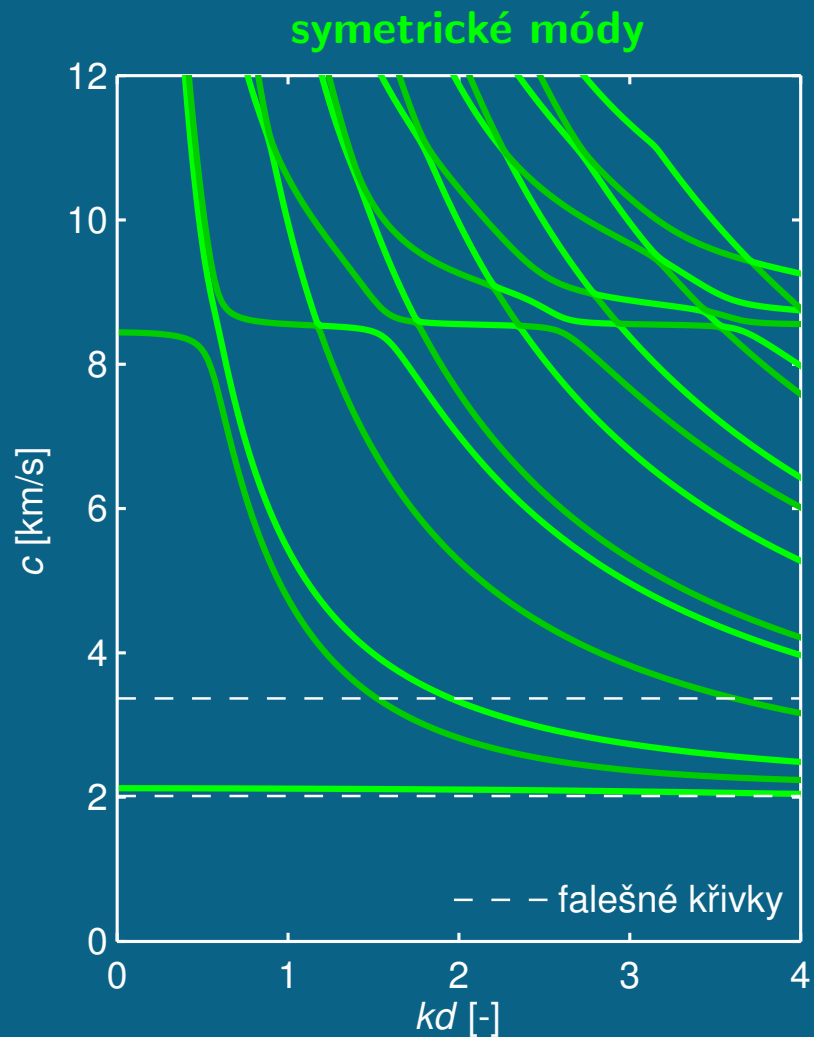
Směr šíření $\phi = 17^\circ$



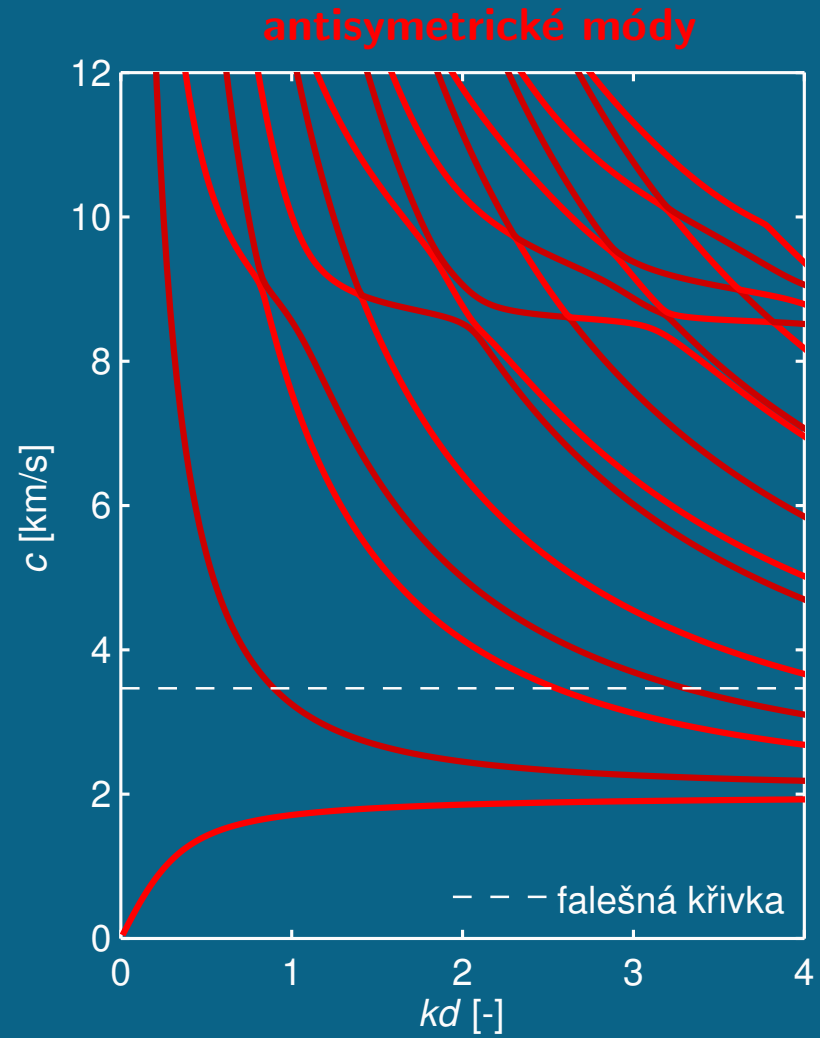
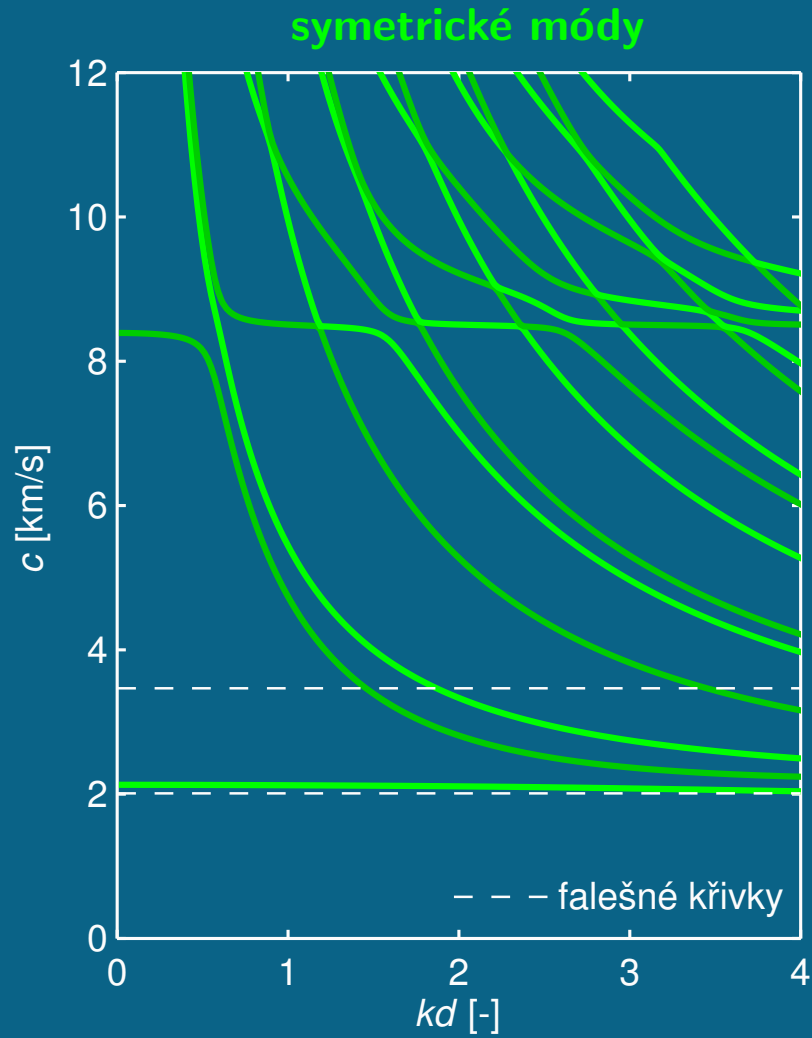
Směr šíření $\phi = 18^\circ$



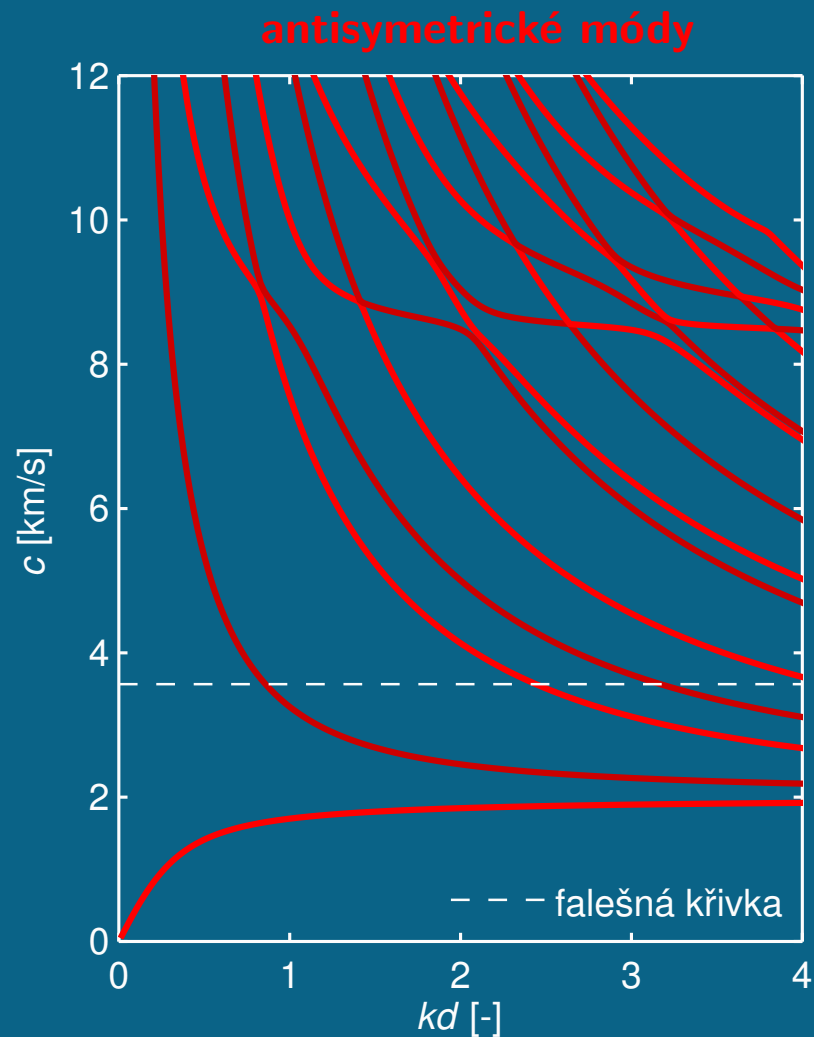
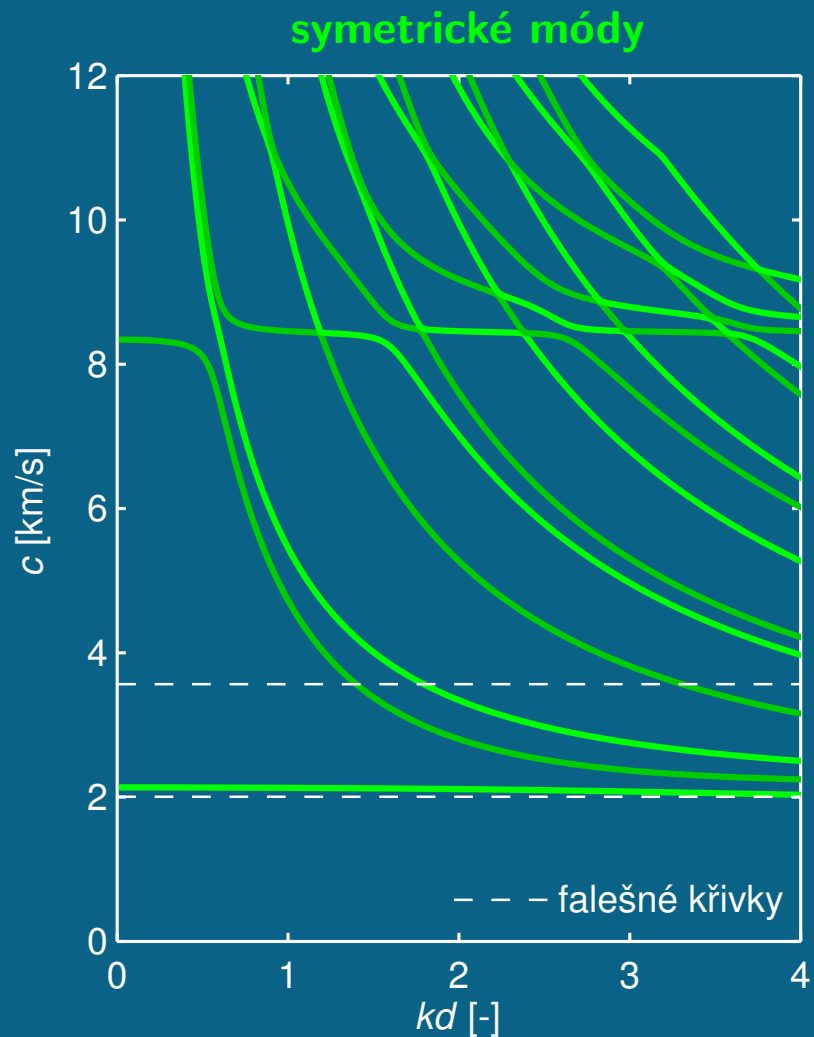
Směr šíření $\phi = 19^\circ$



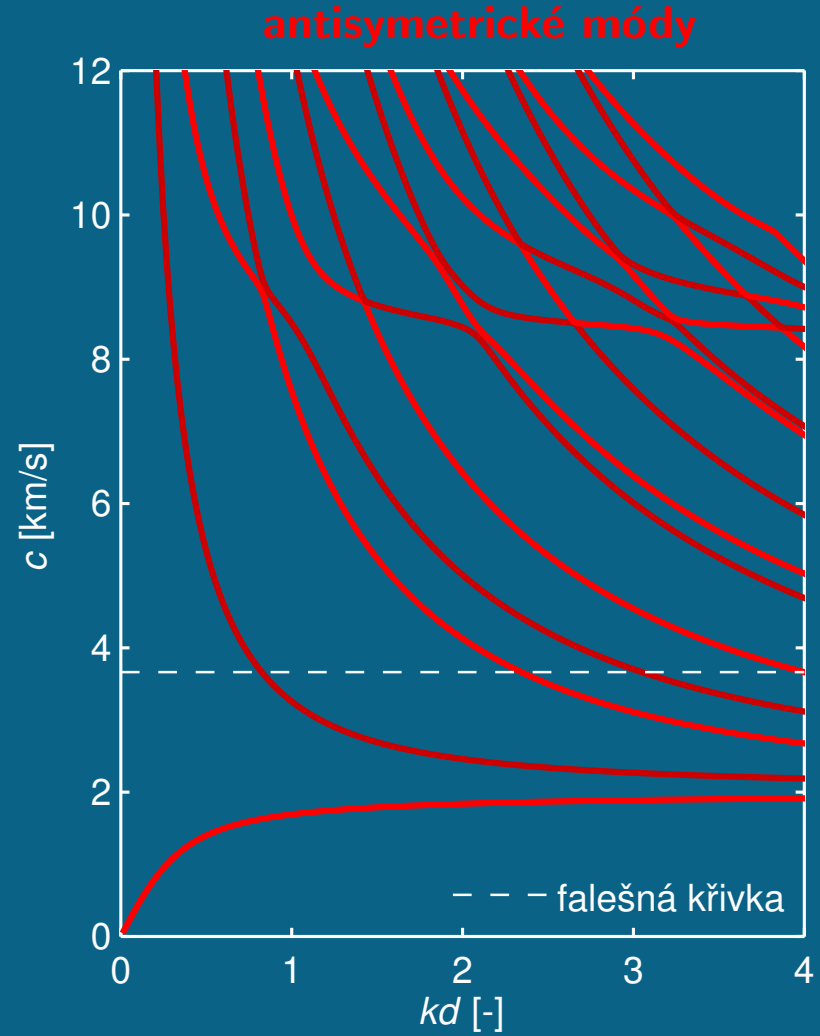
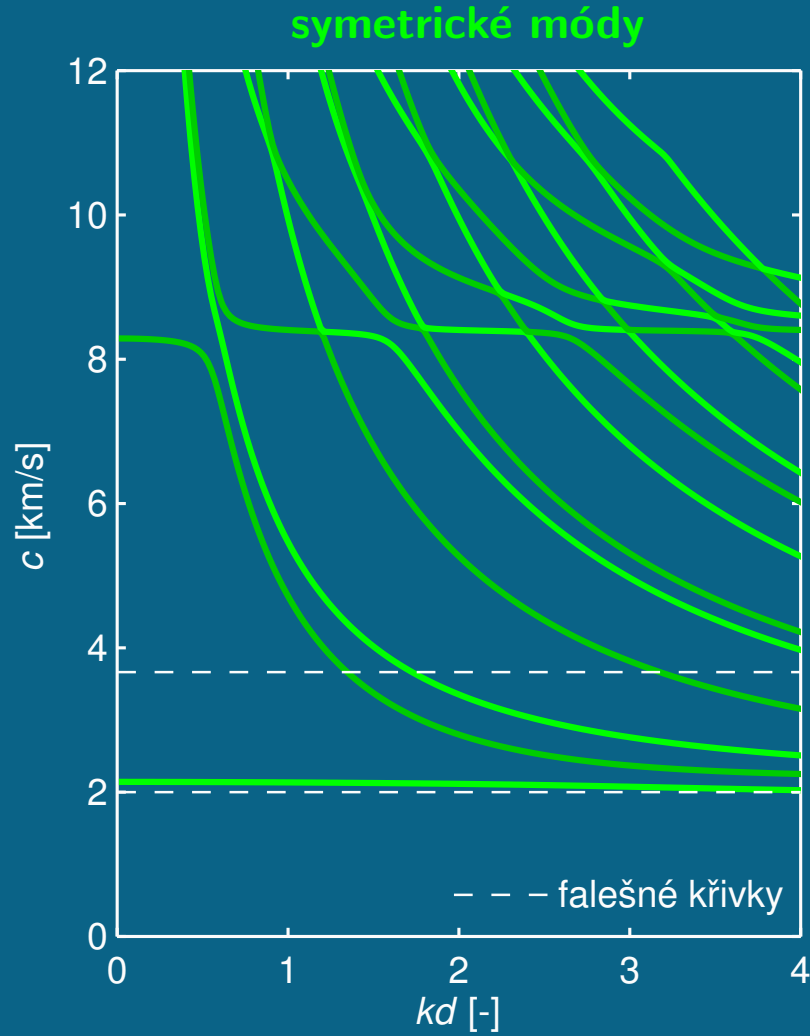
Směr šíření $\phi = 20^\circ$



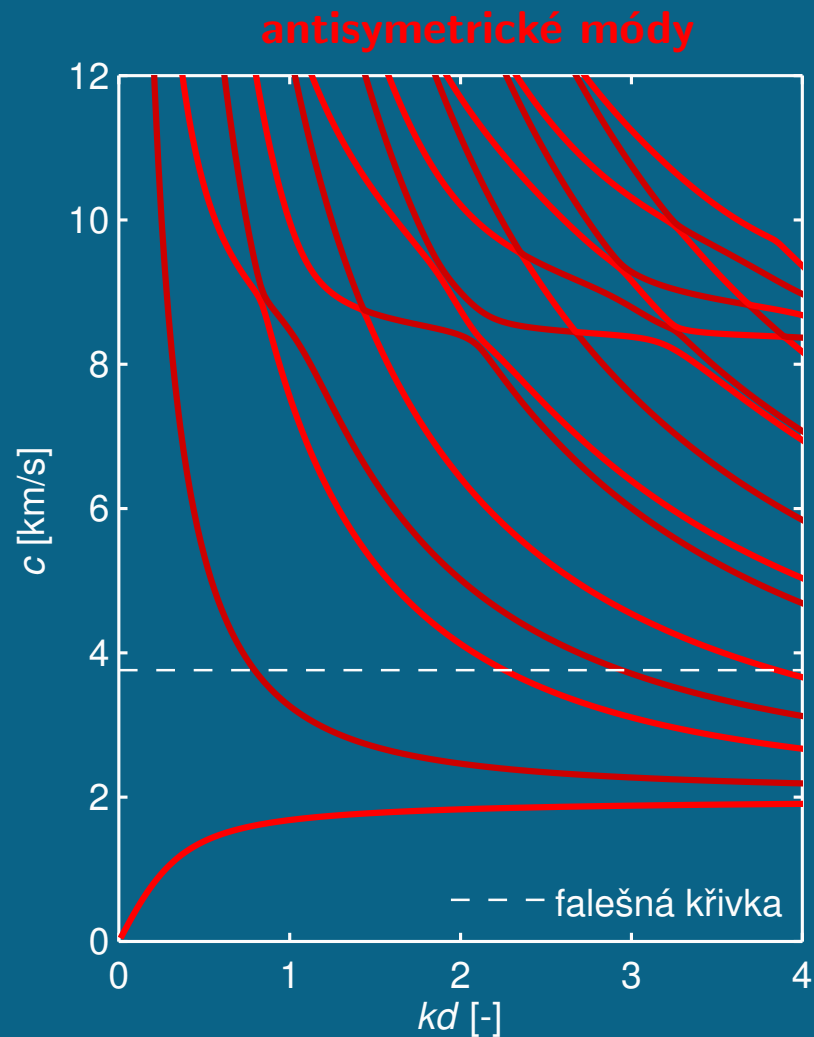
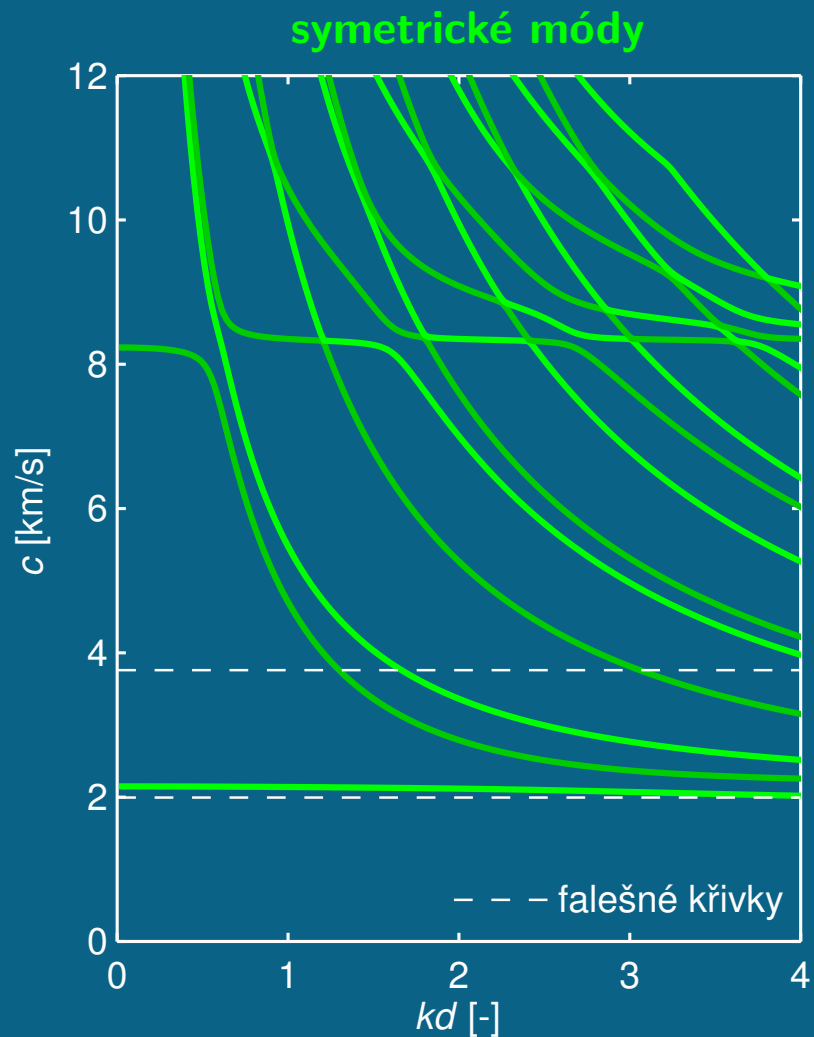
Směr šíření $\phi = 21^\circ$



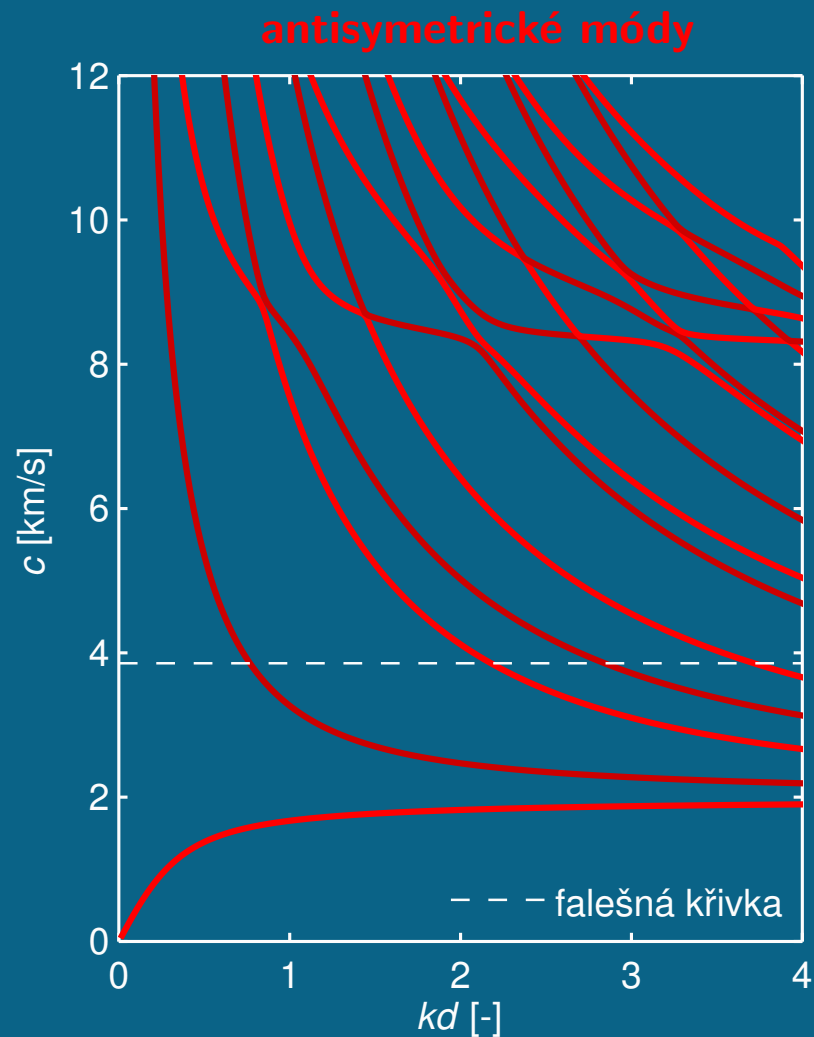
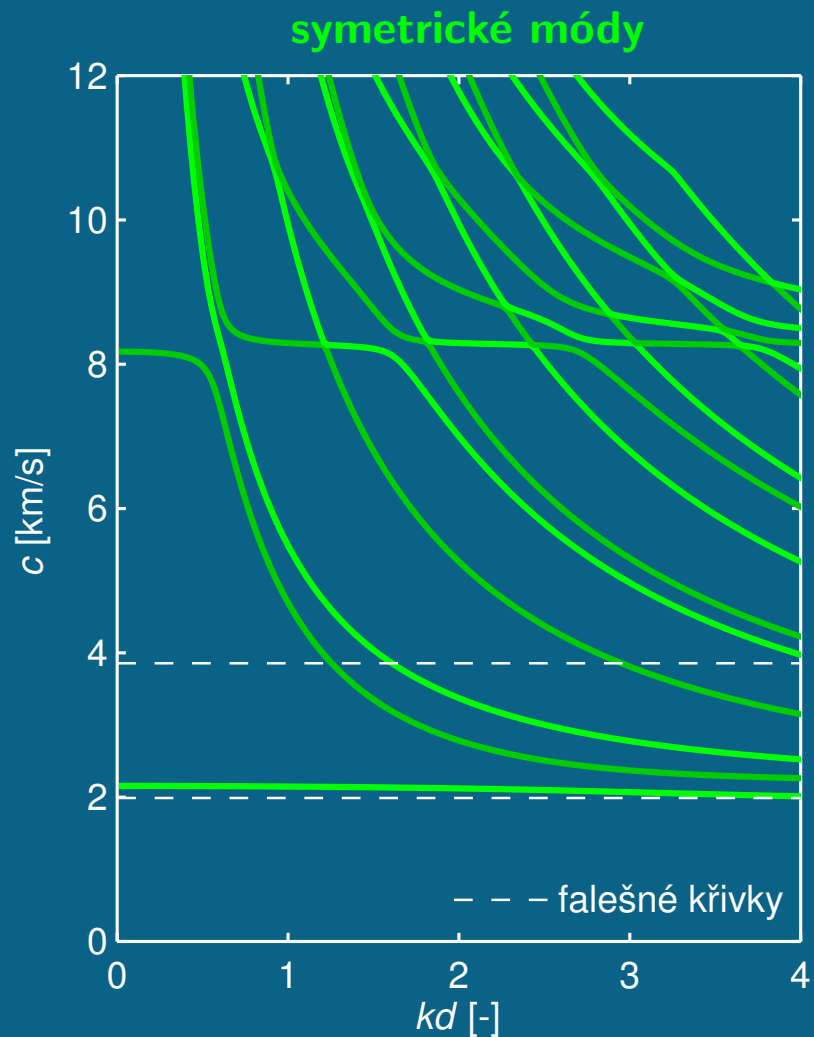
Směr šíření $\phi = 22^\circ$



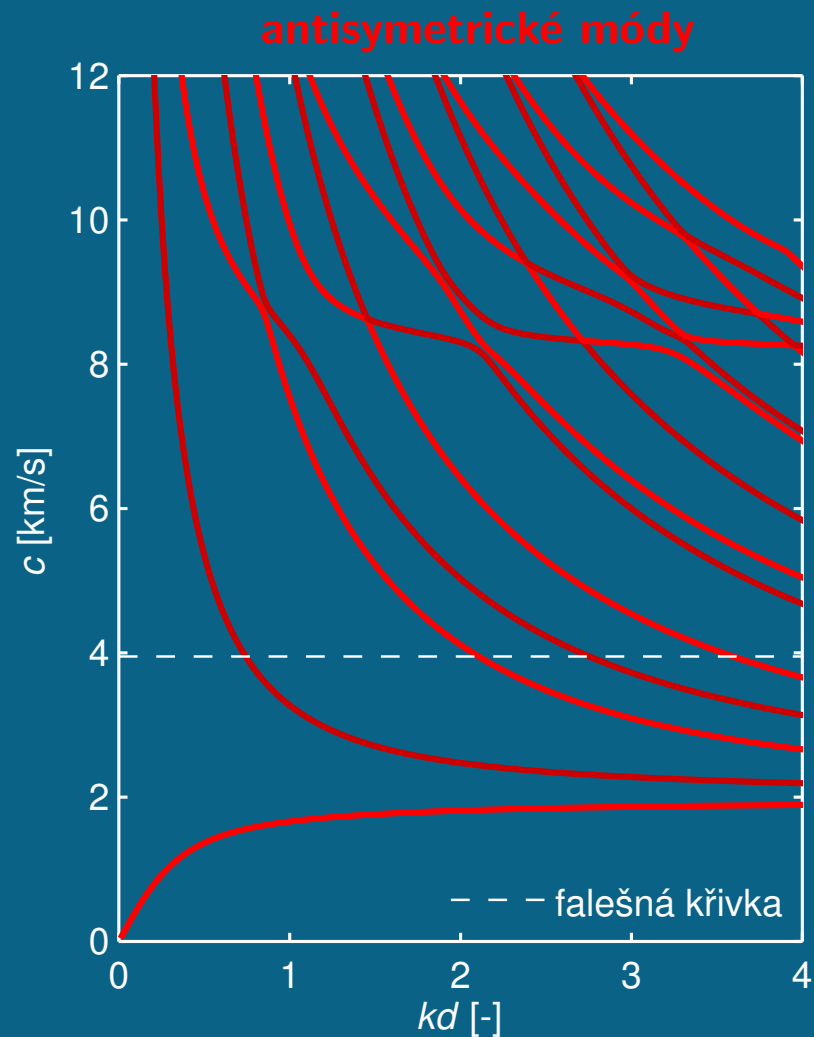
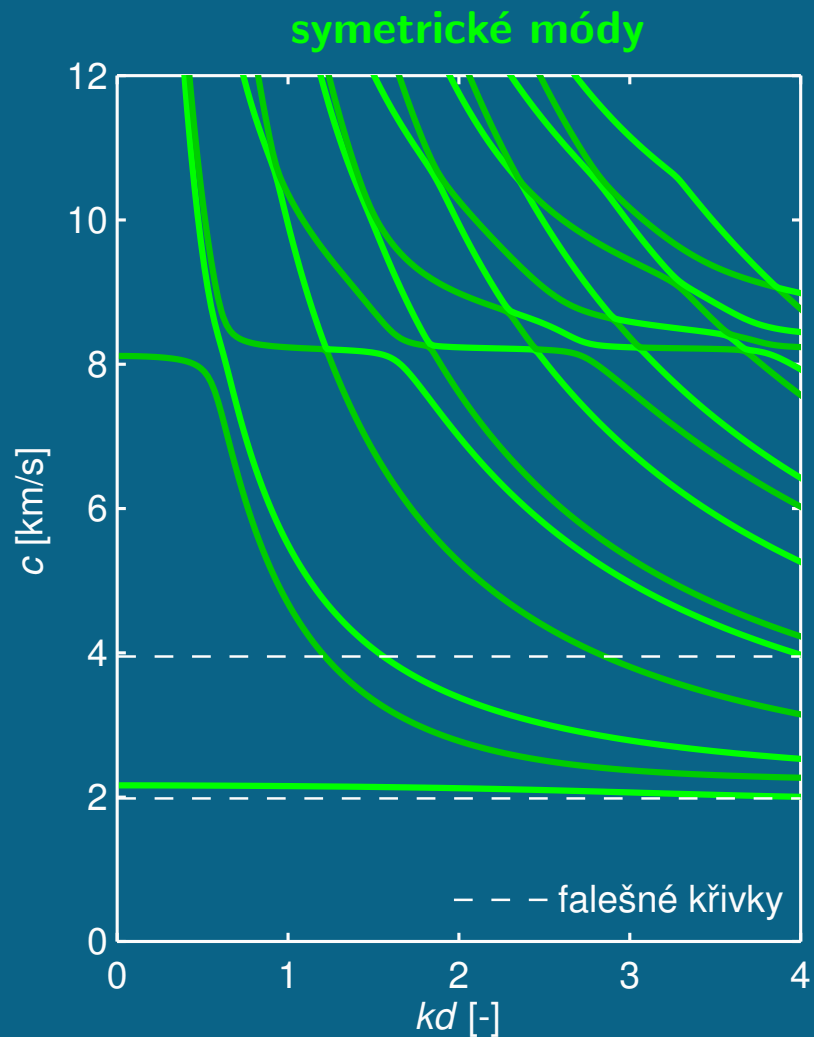
Směr šíření $\phi = 23^\circ$



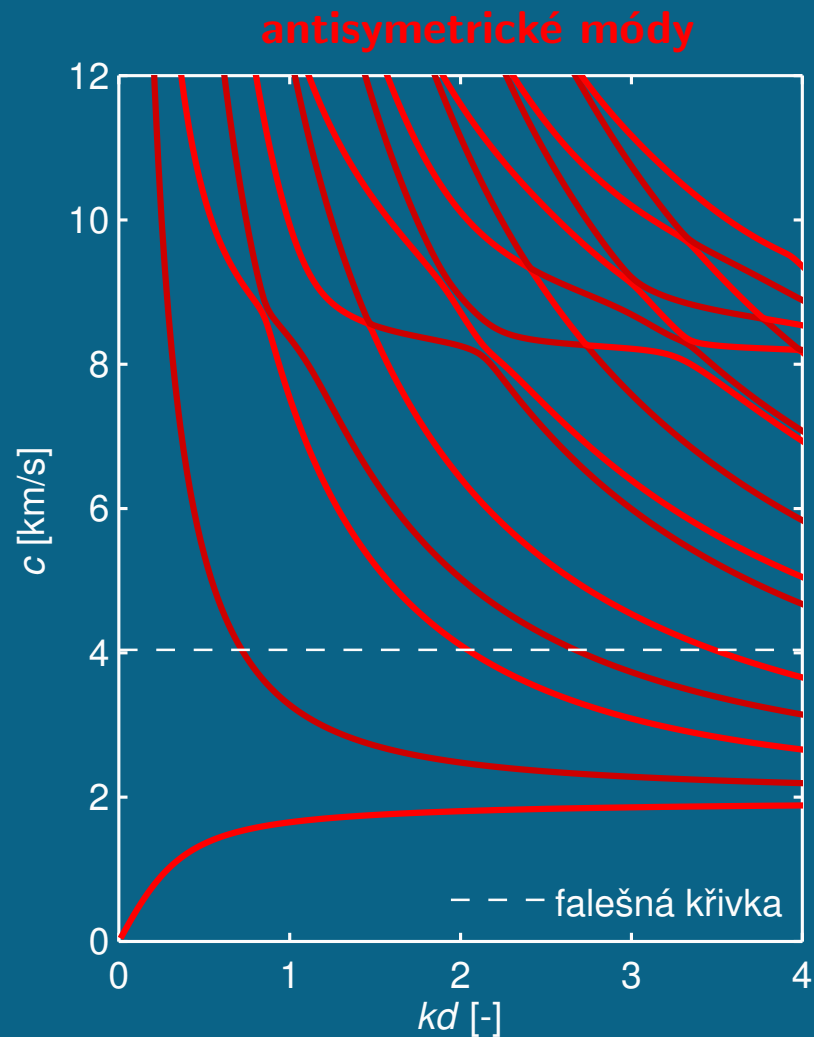
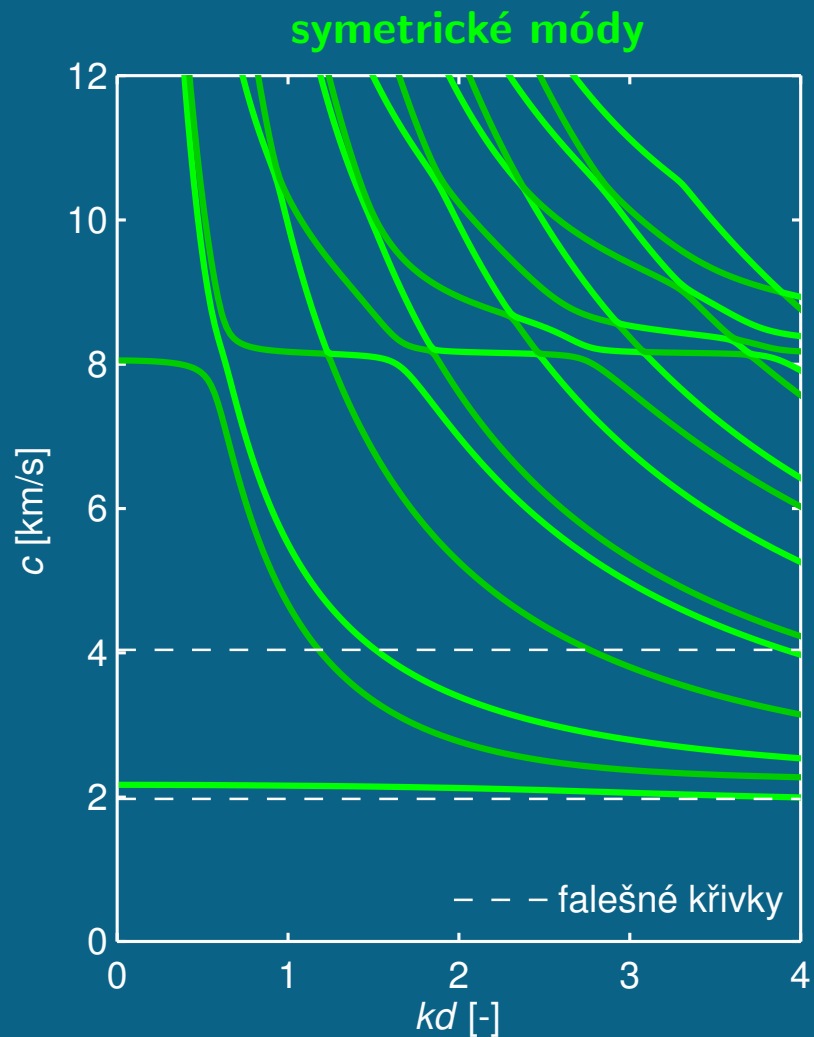
Směr šíření $\phi = 24^\circ$



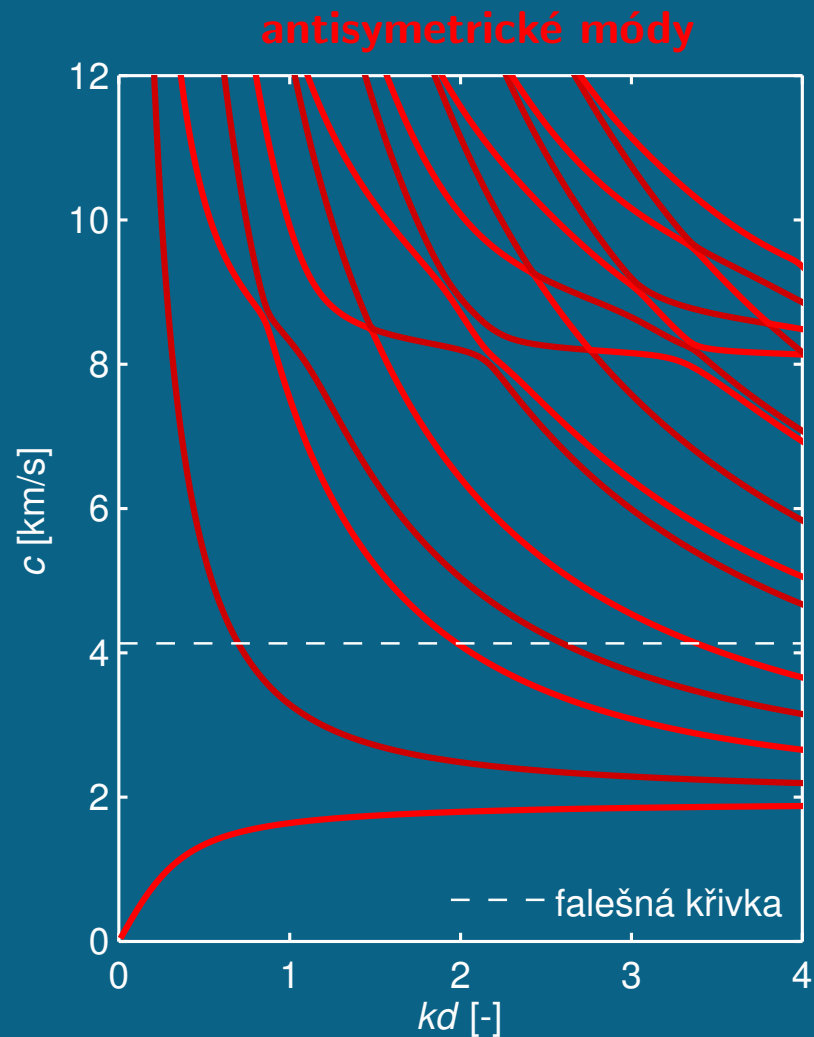
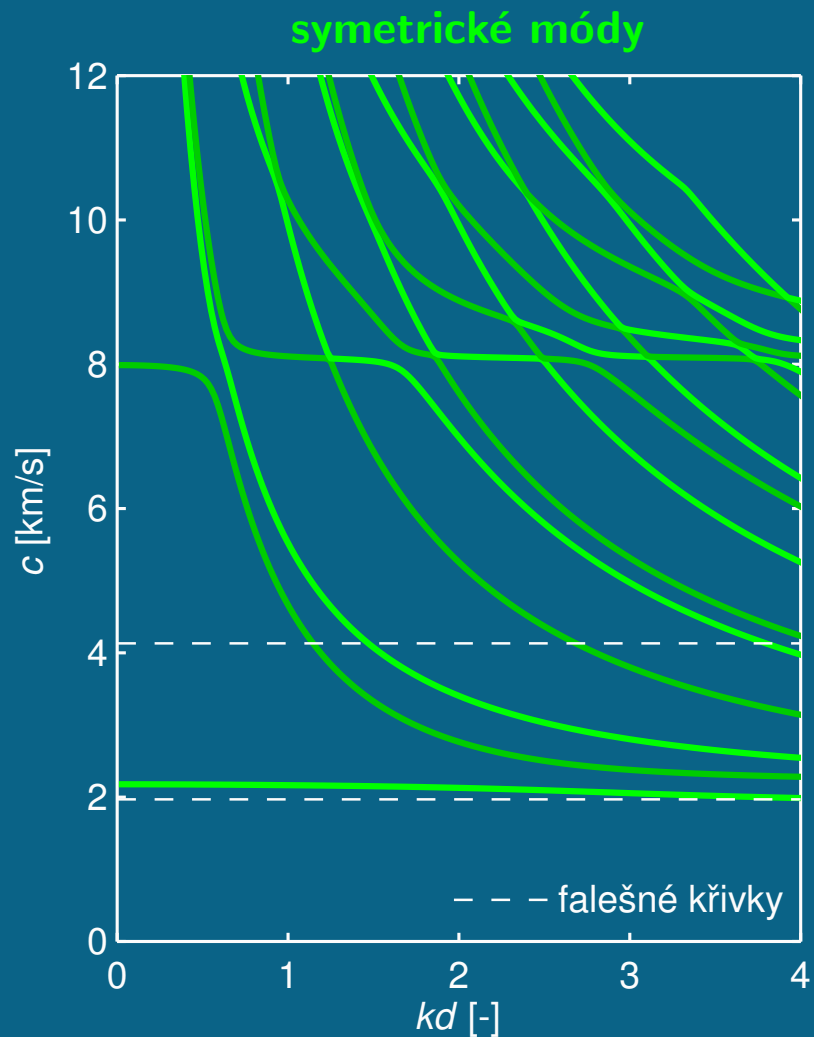
Směr šíření $\phi = 25^\circ$



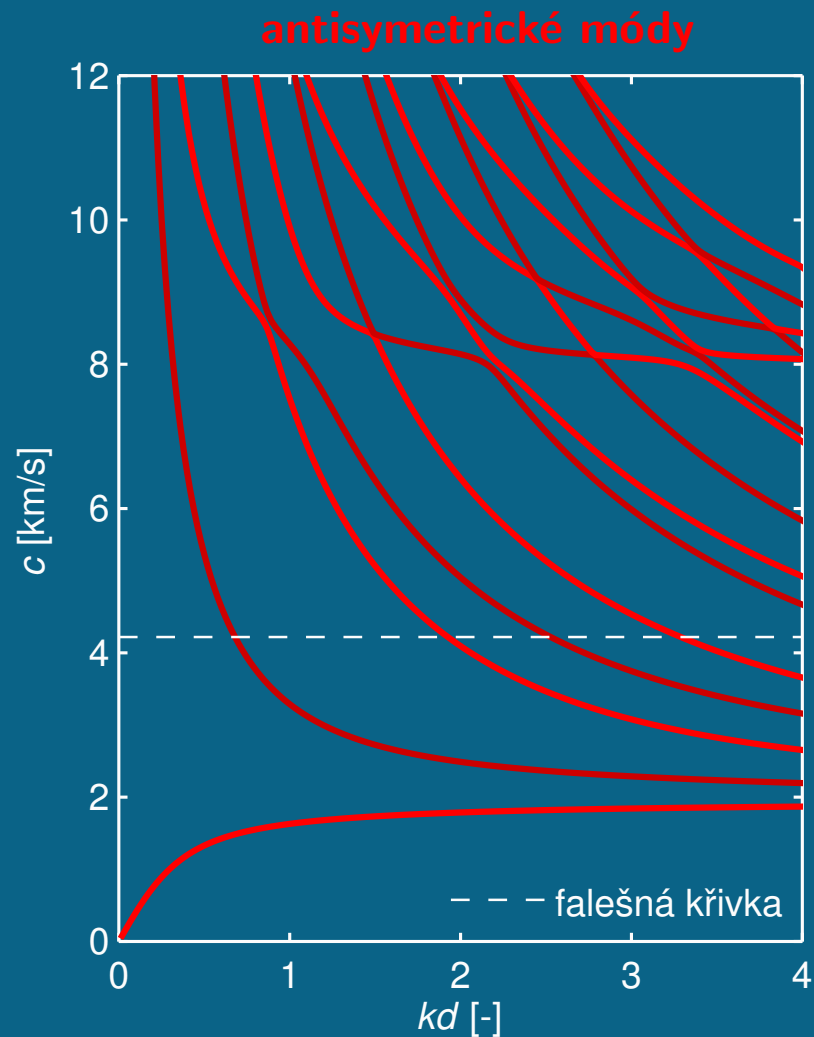
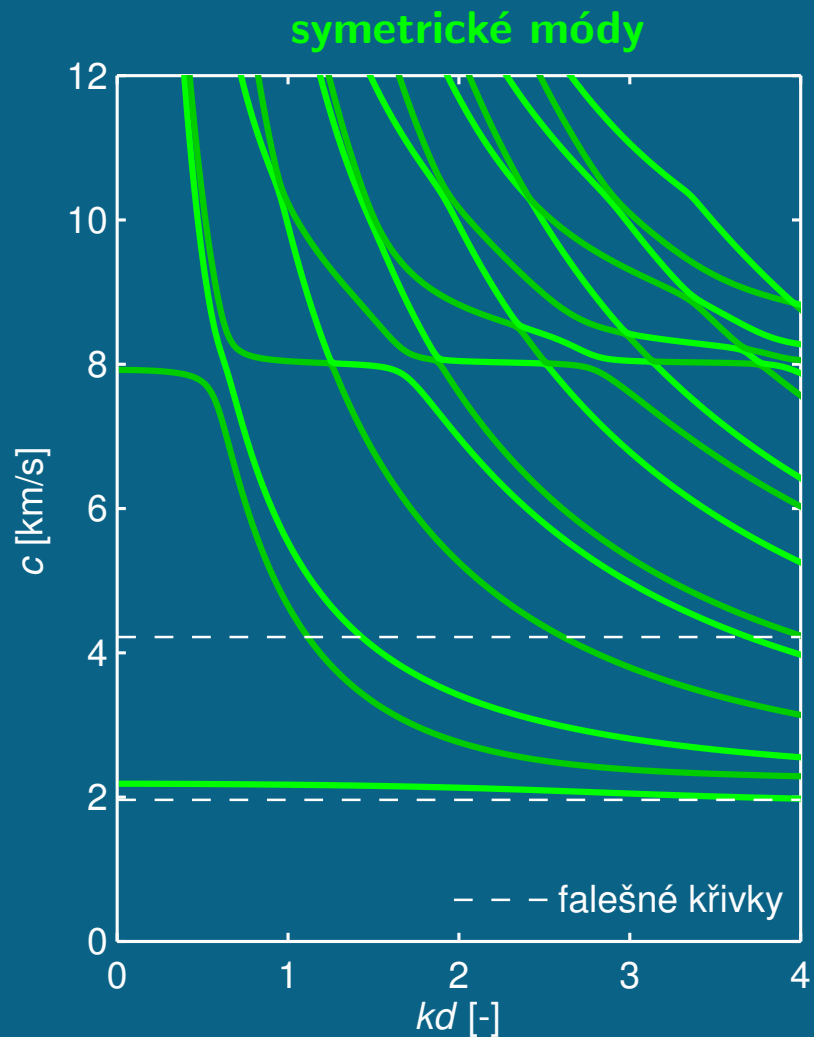
Směr šíření $\phi = 26^\circ$



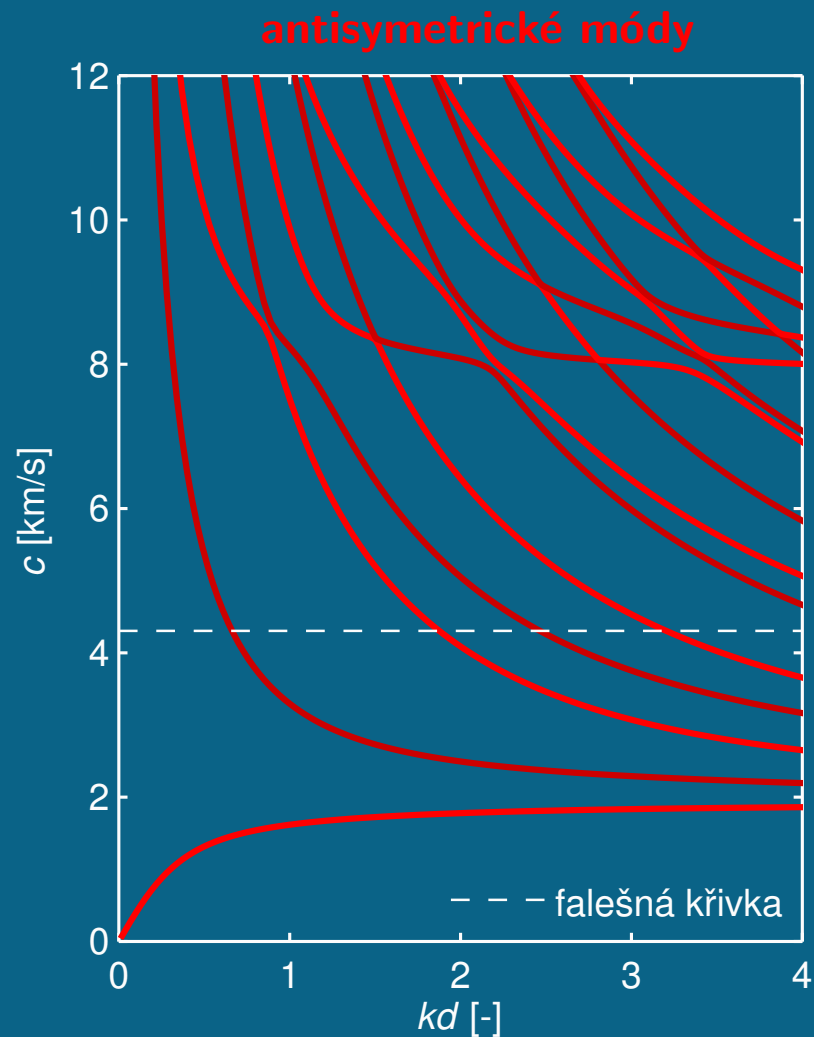
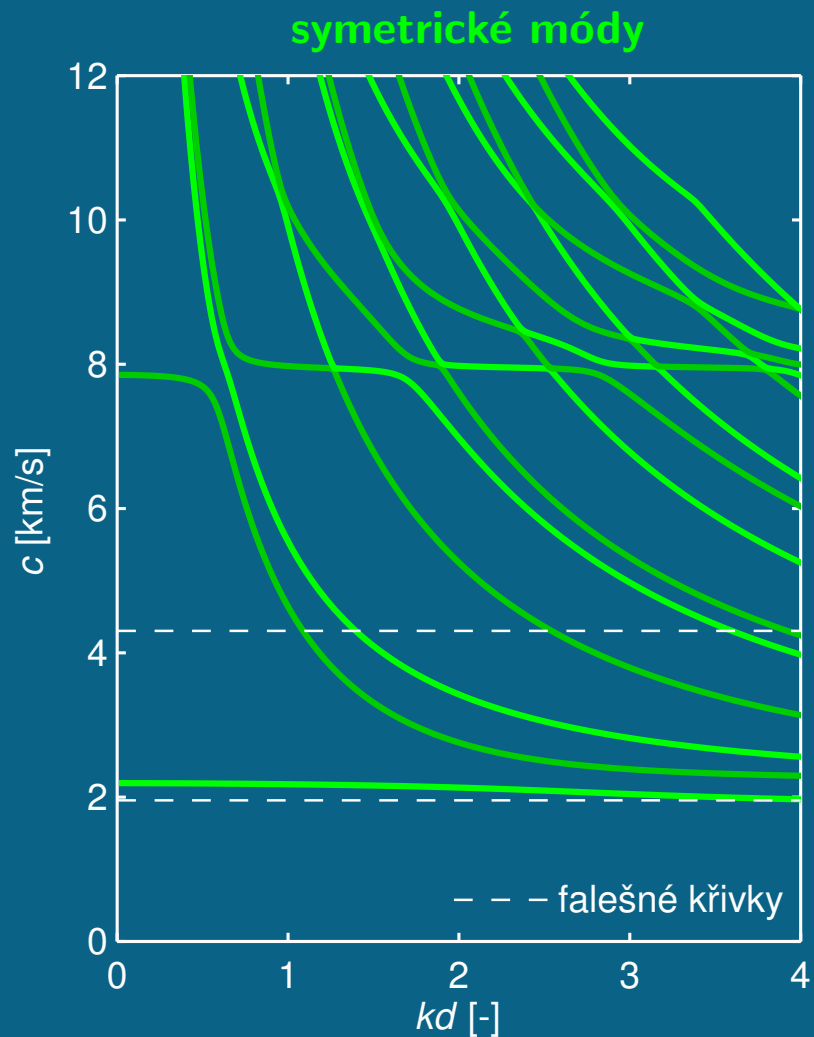
Směr šíření $\phi = 27^\circ$



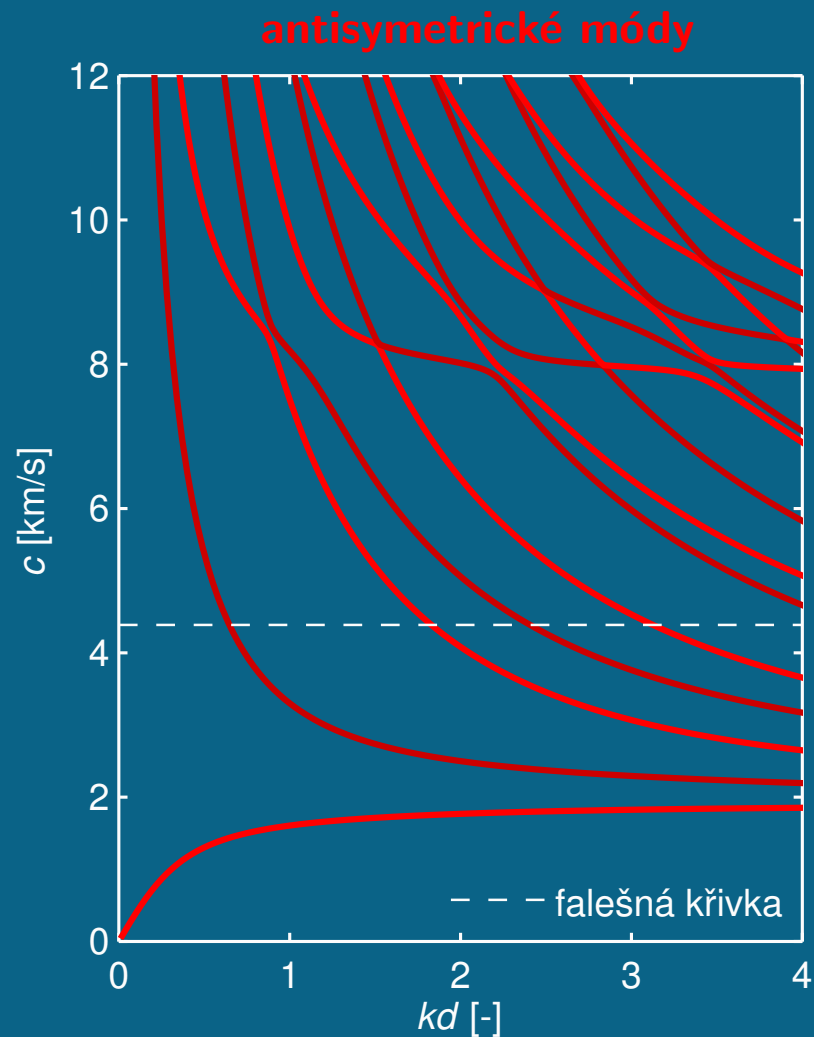
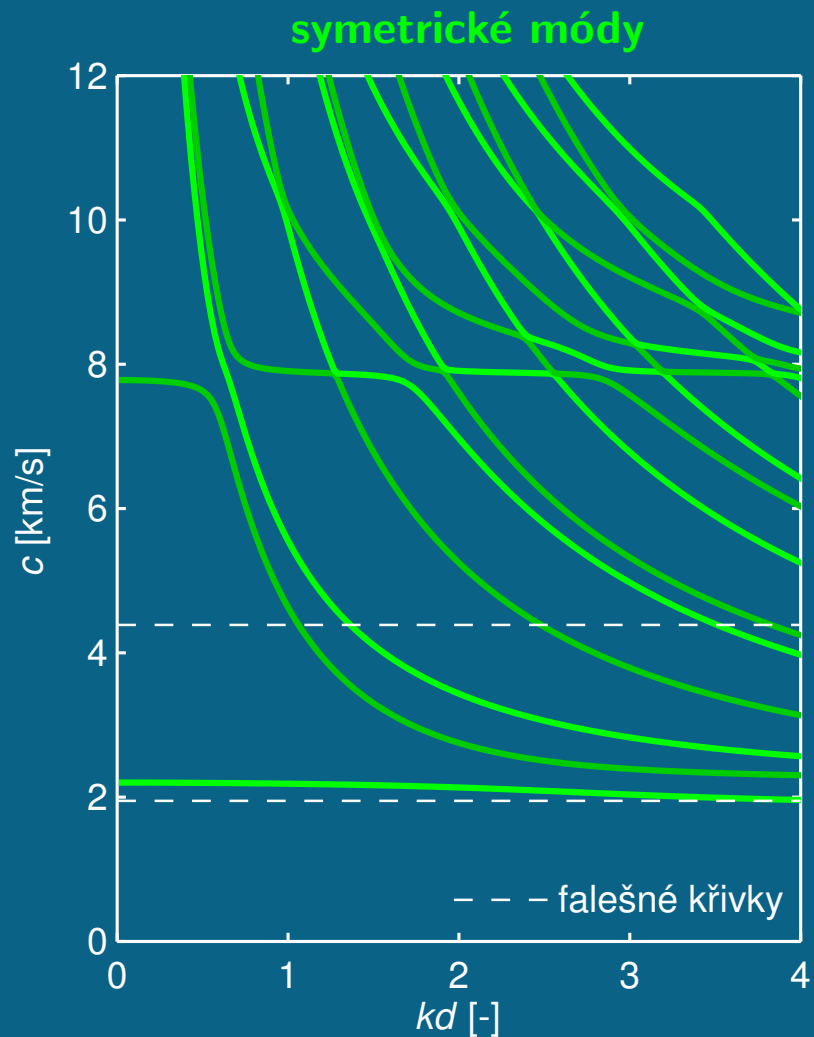
Směr šíření $\phi = 28^\circ$



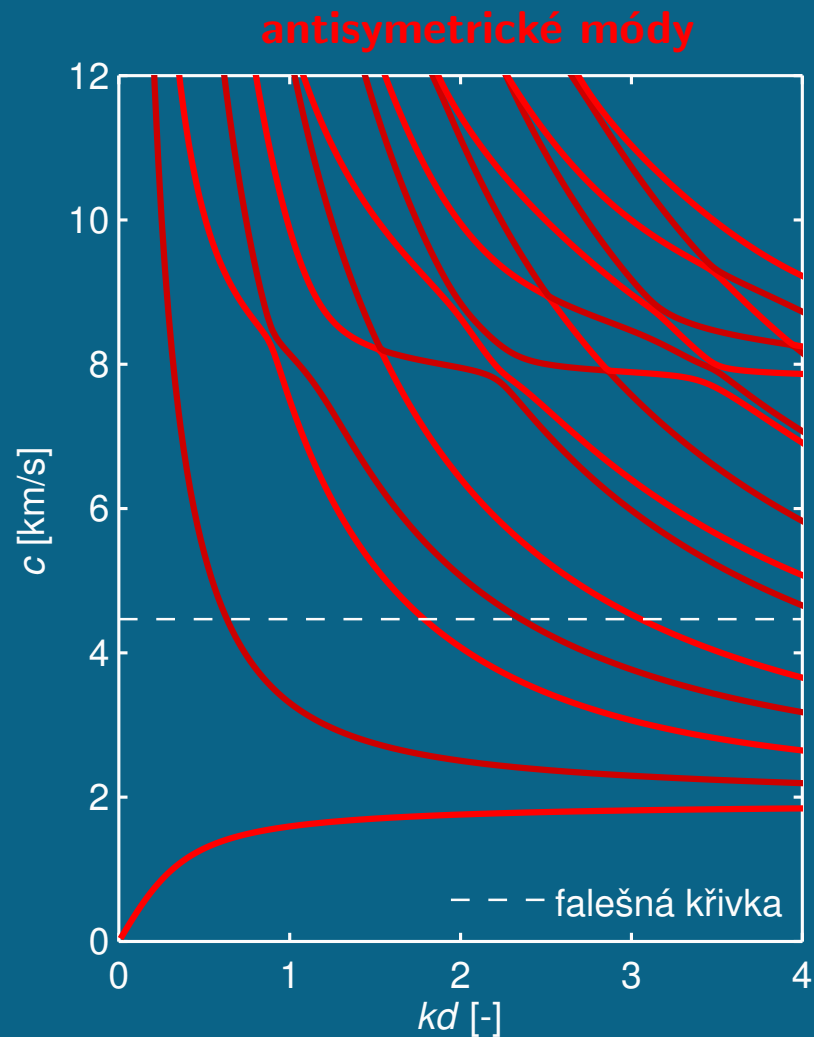
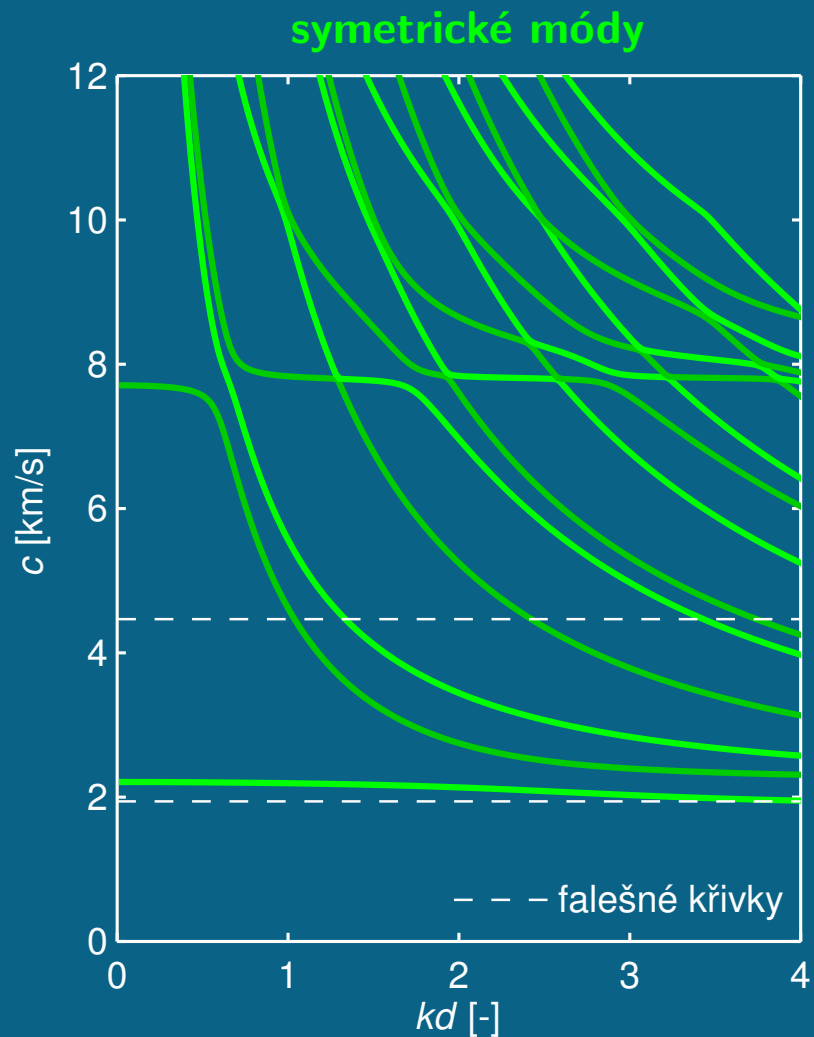
Směr šíření $\phi = 29^\circ$



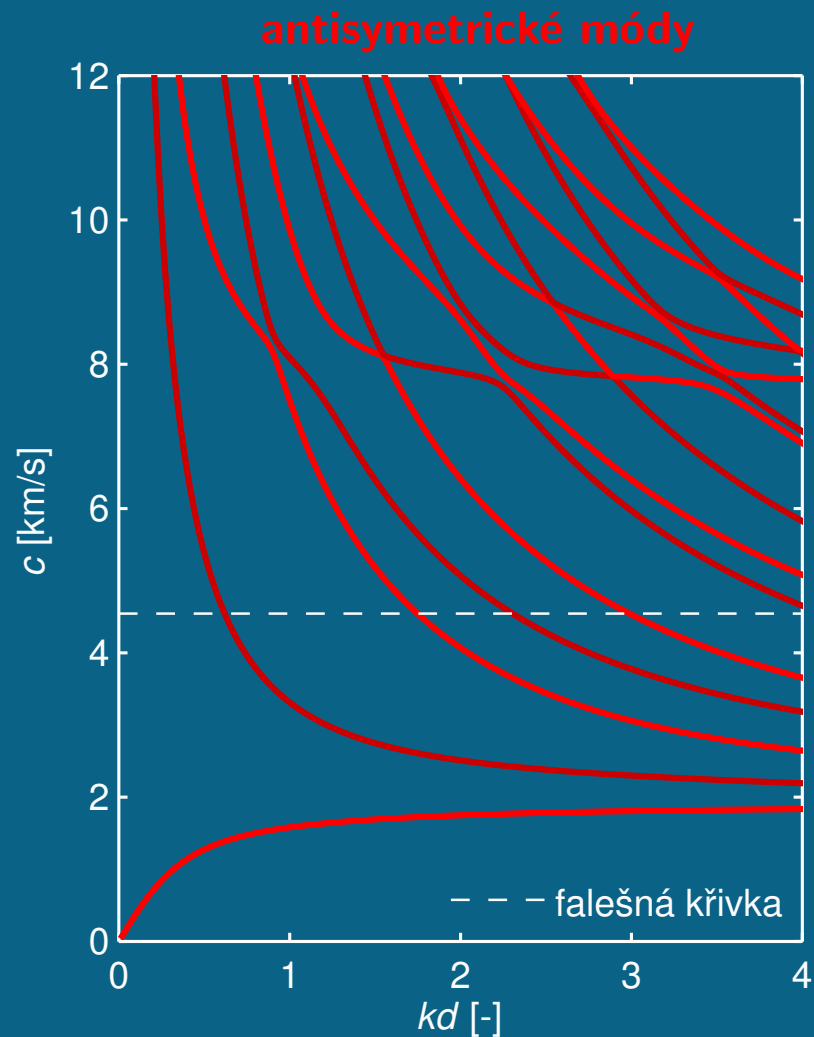
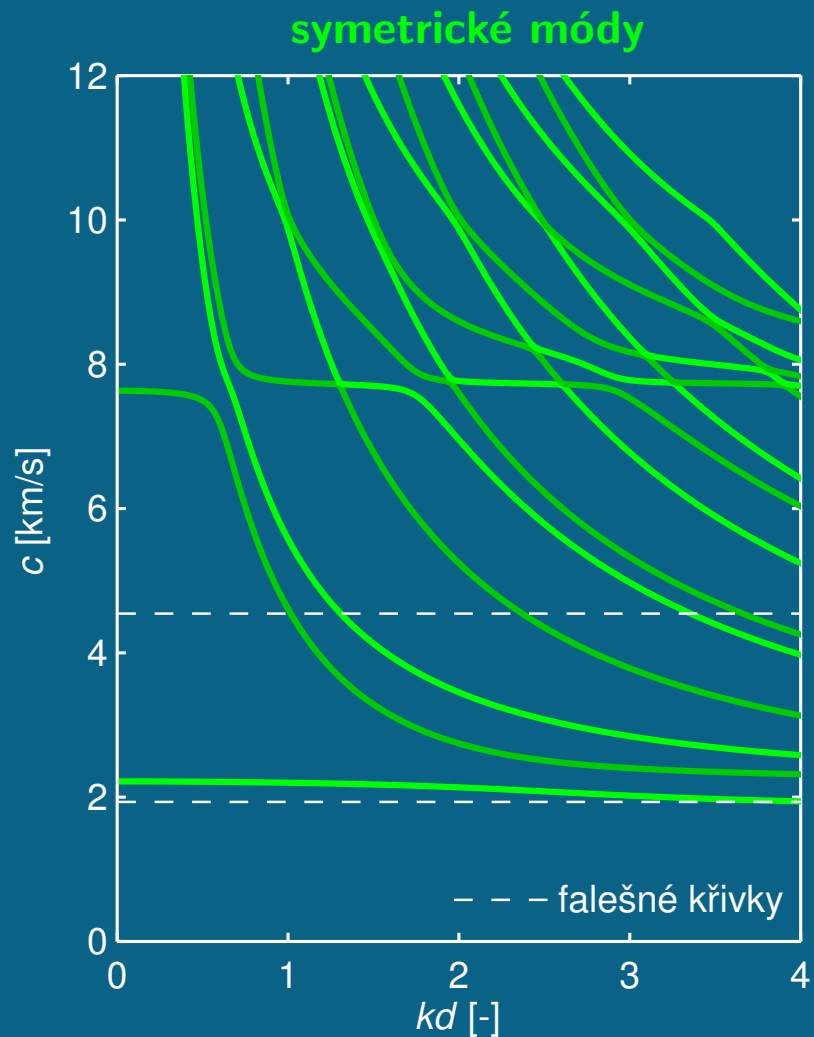
Směr šíření $\phi = 30^\circ$



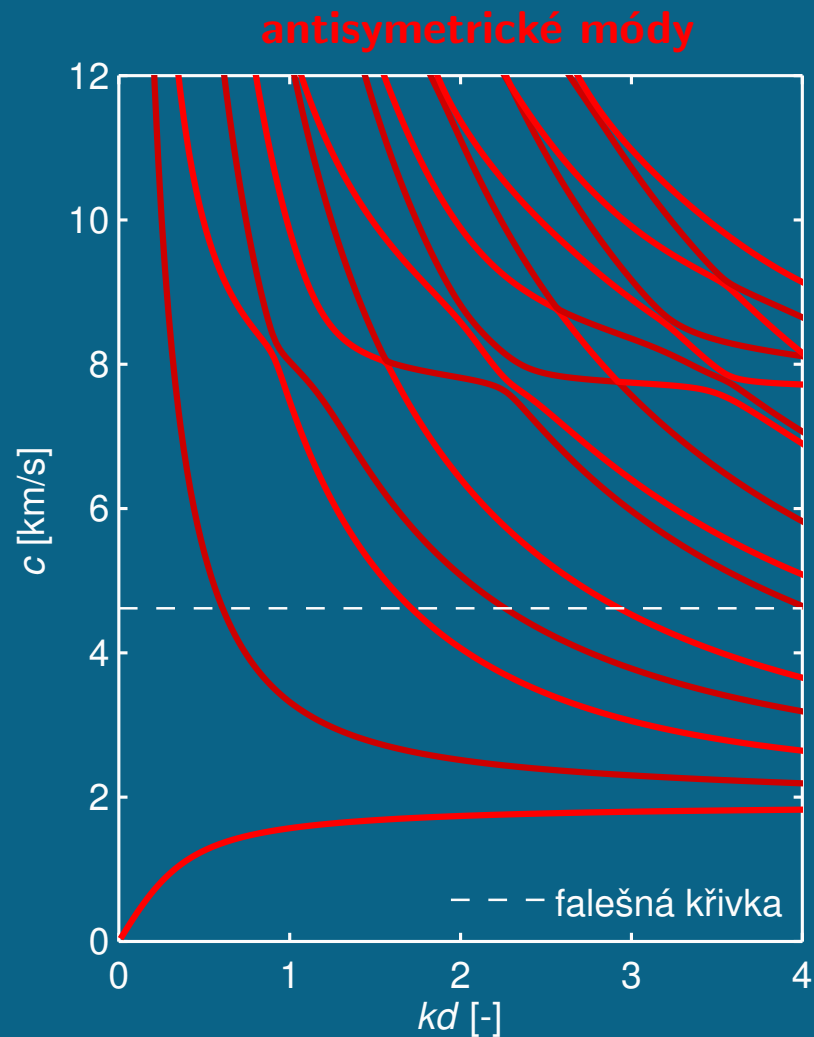
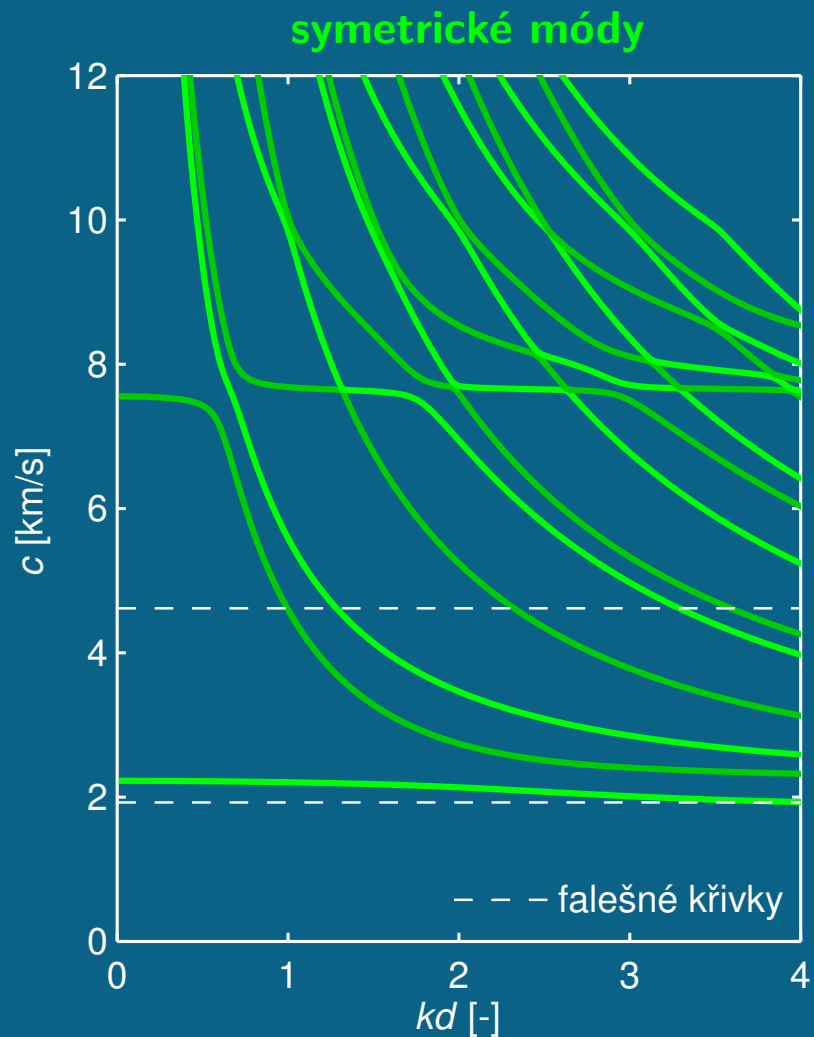
Směr šíření $\phi = 31^\circ$



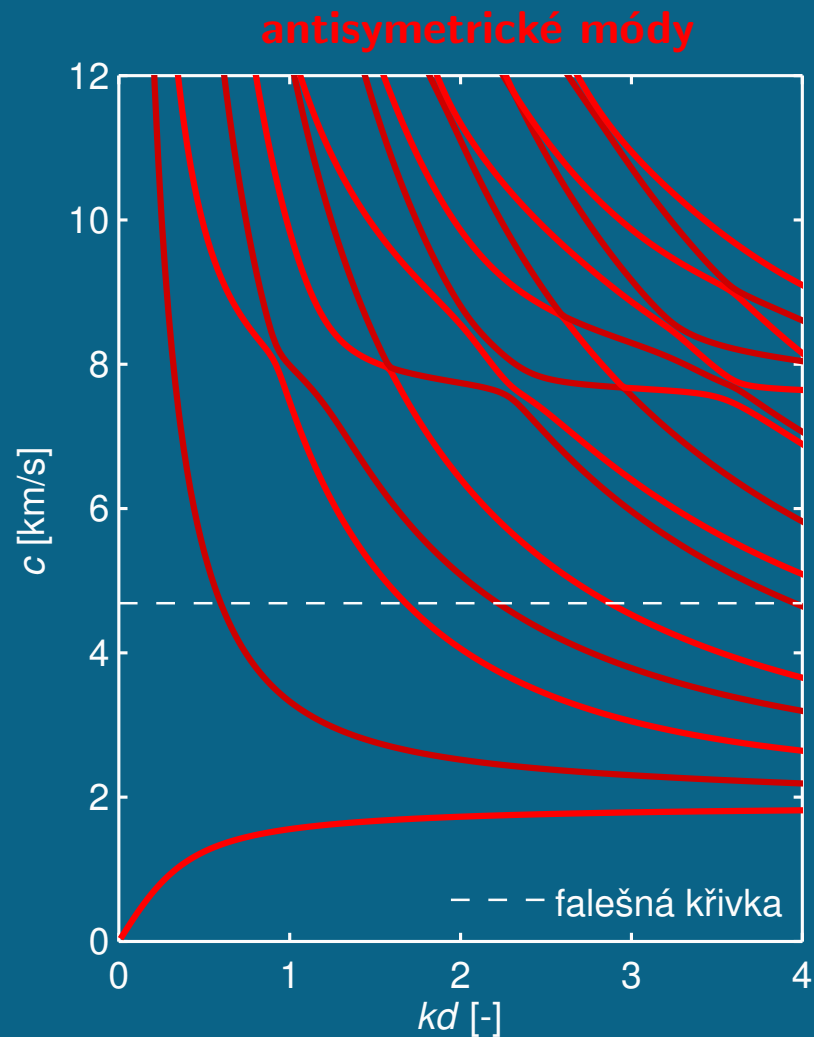
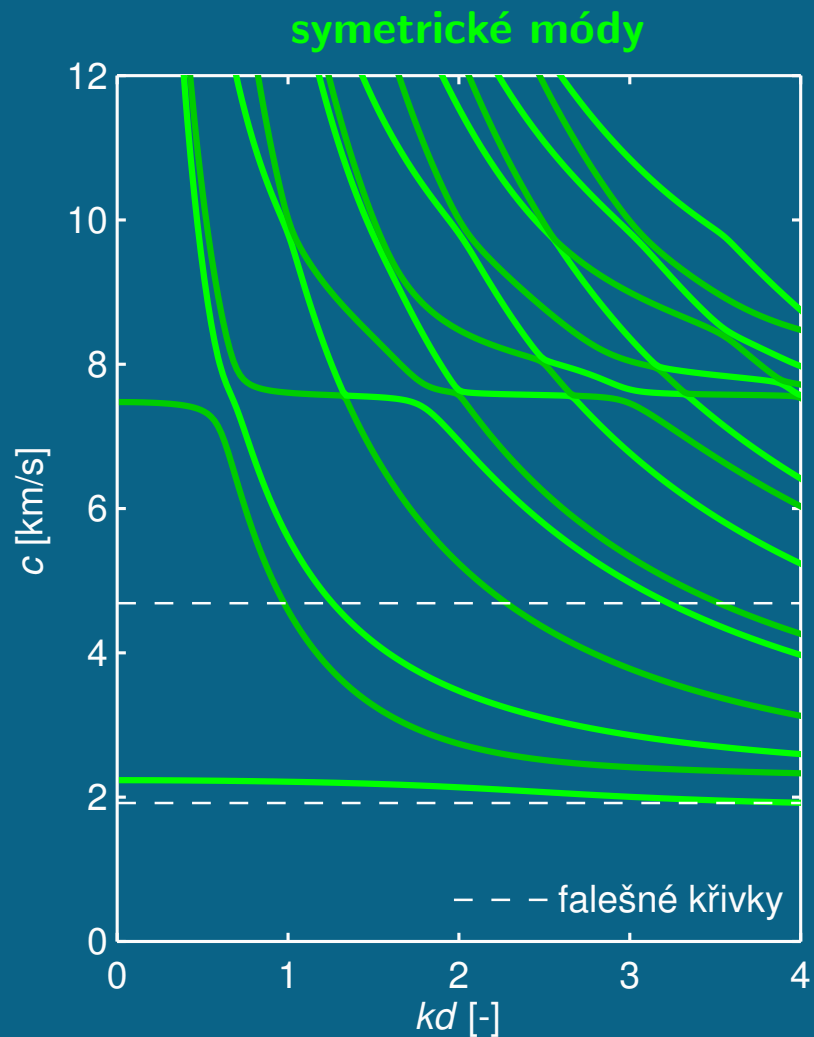
Směr šíření $\phi = 32^\circ$



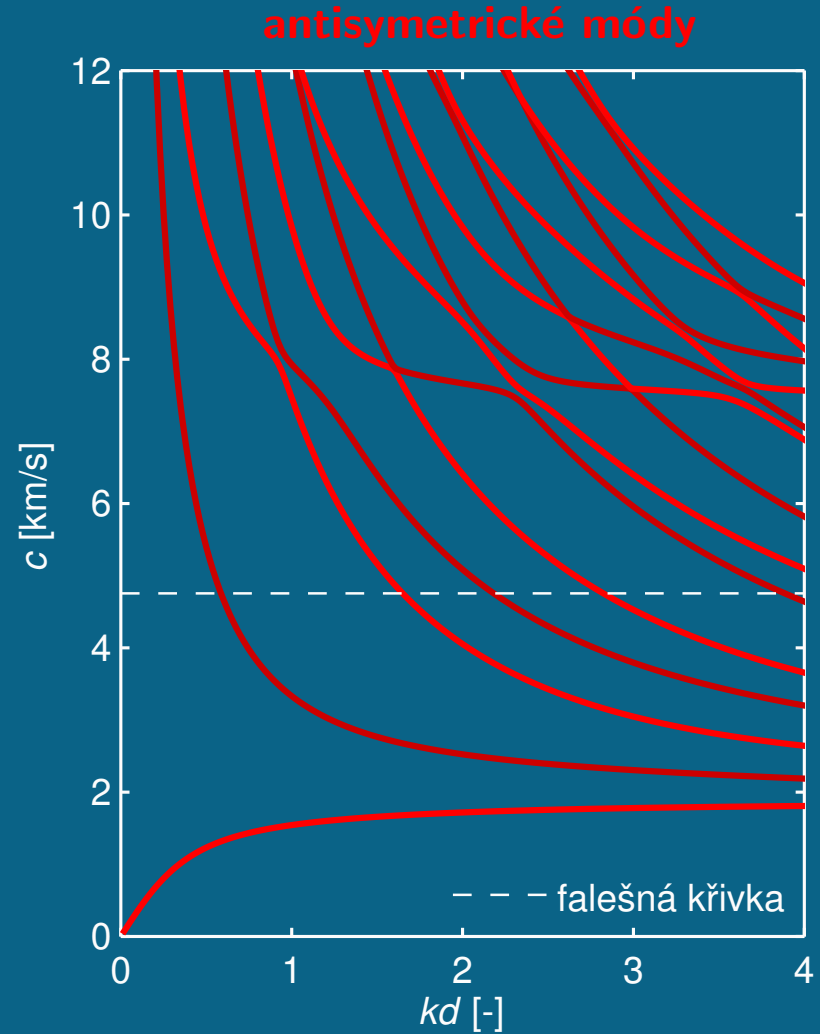
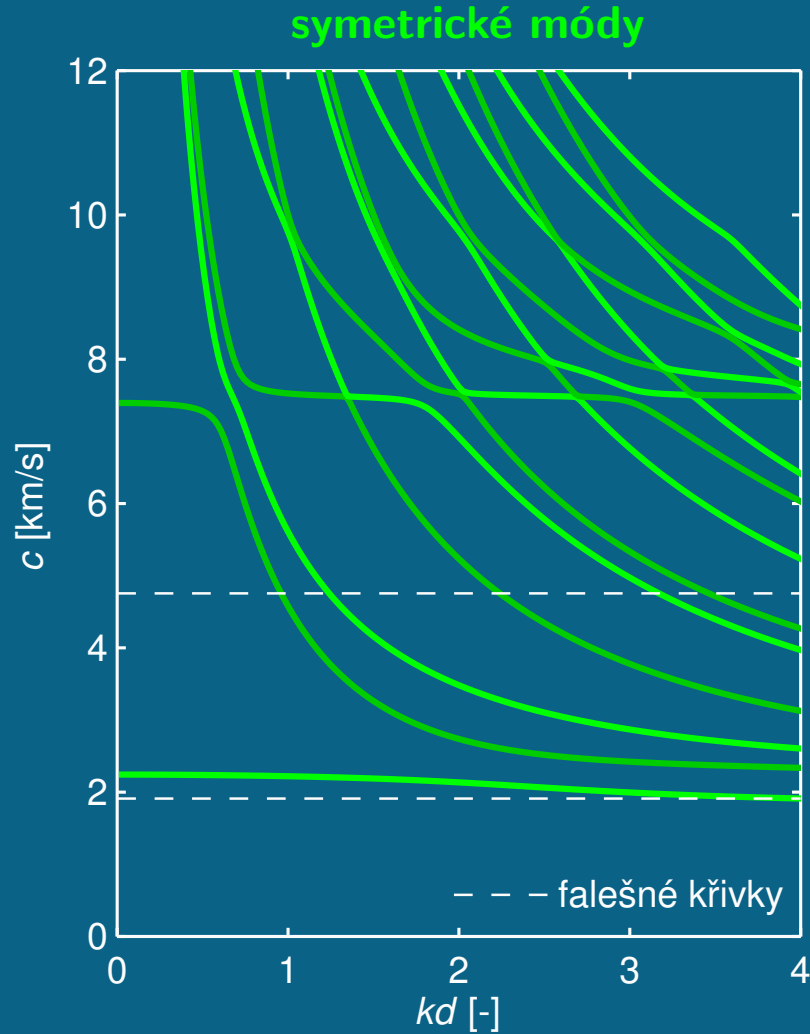
Směr šíření $\phi = 33^\circ$



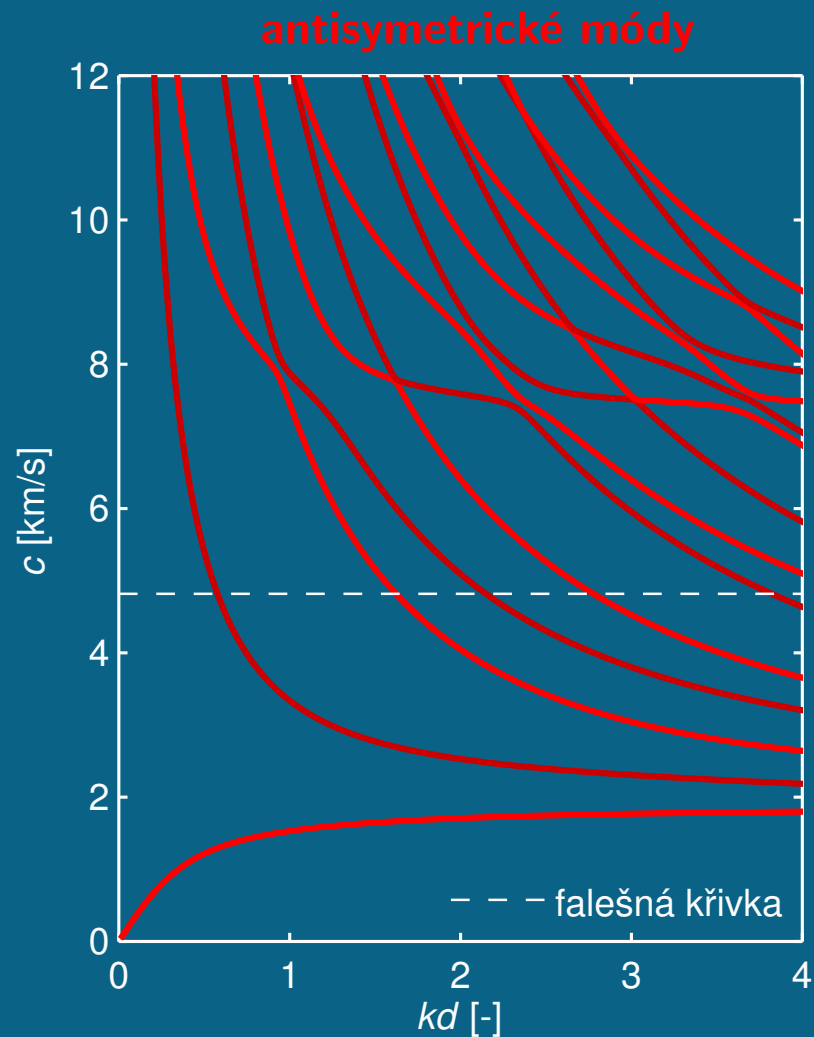
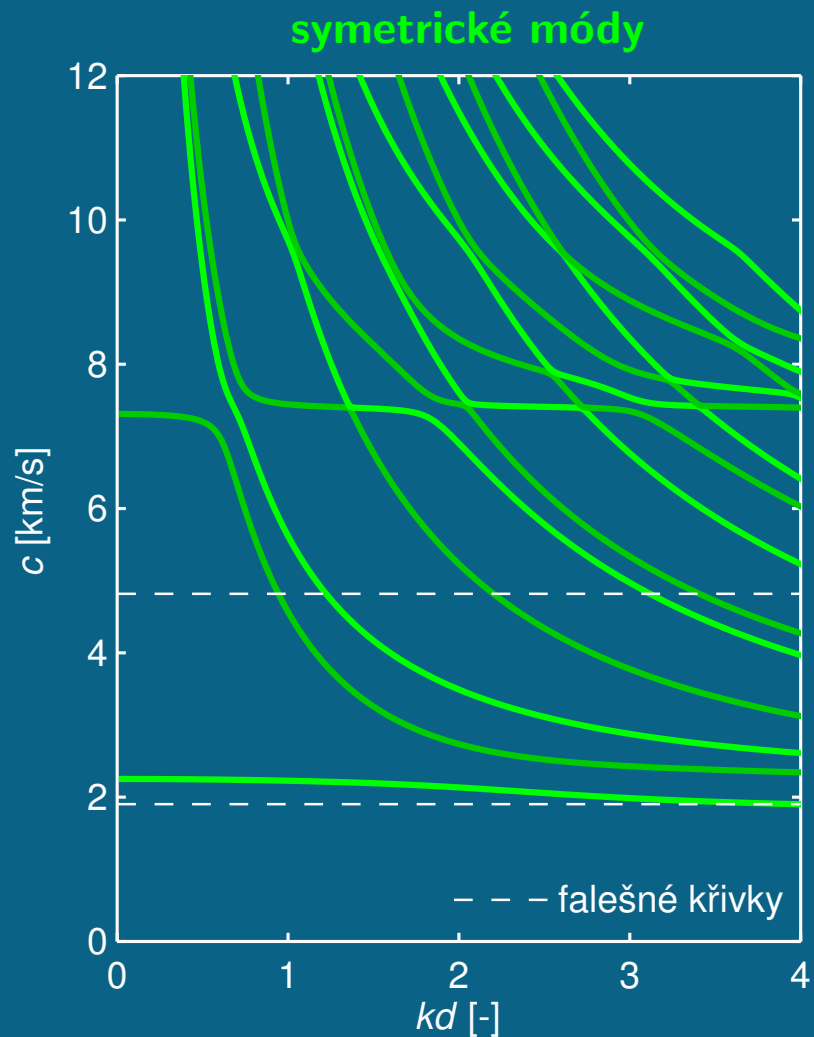
Směr šíření $\phi = 34^\circ$



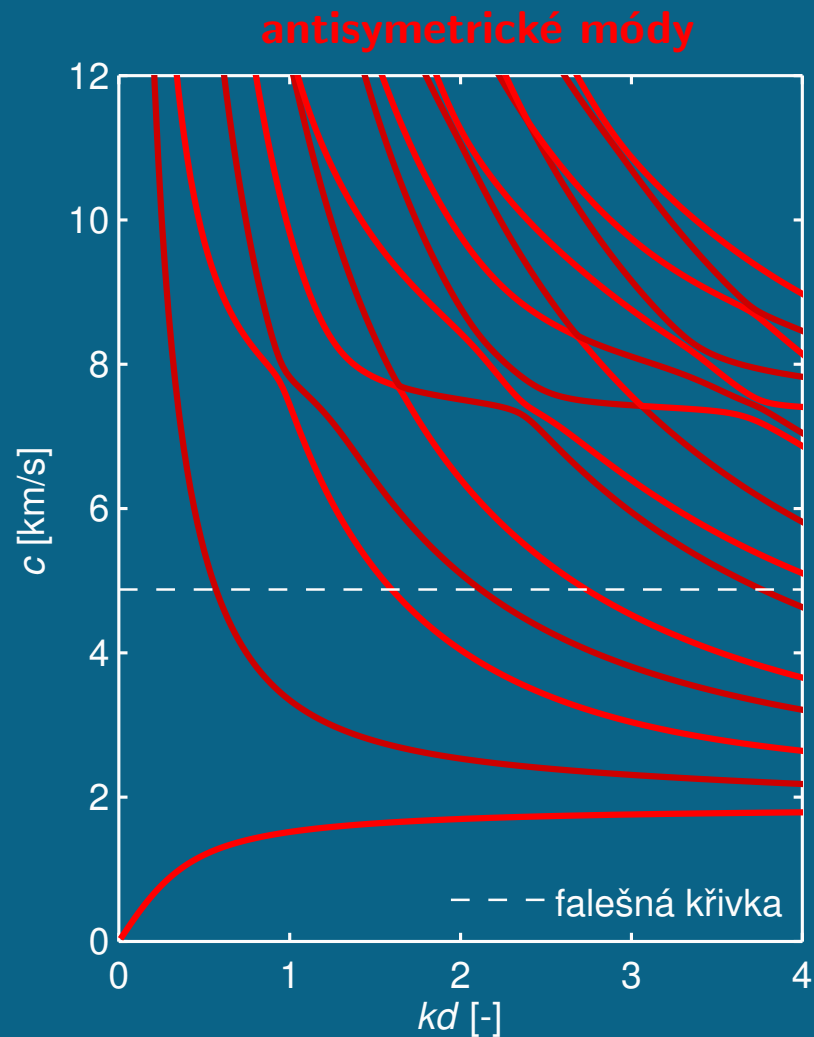
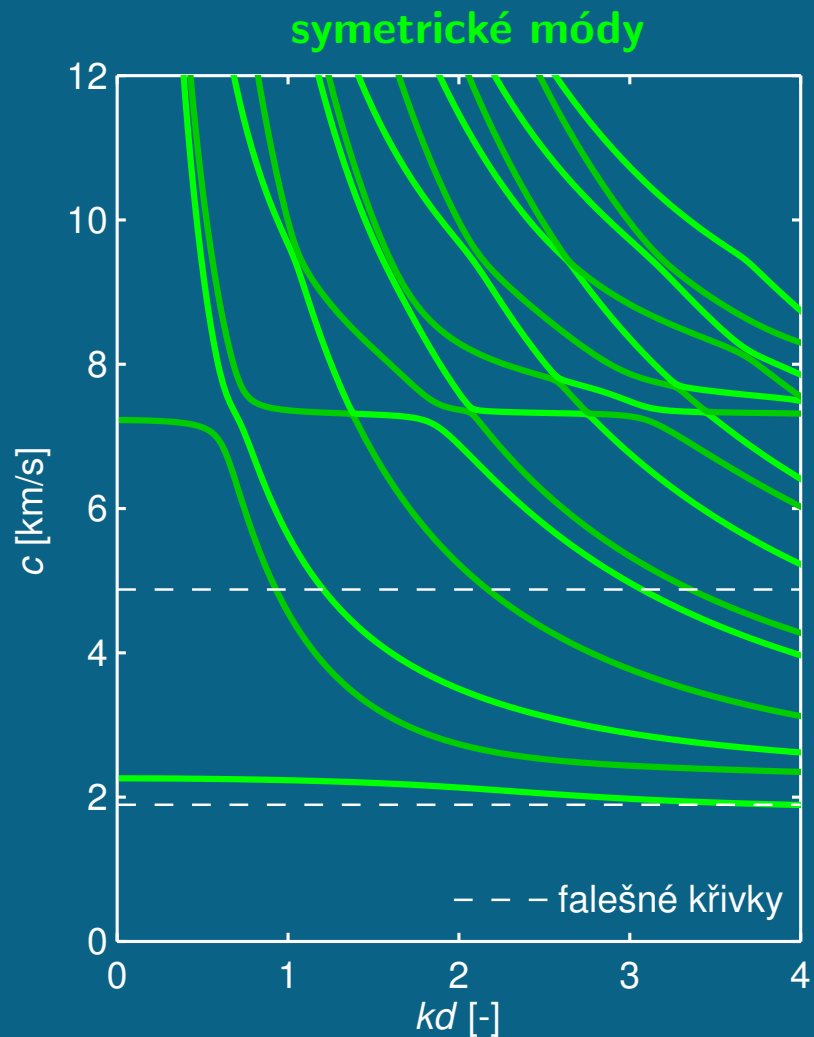
Směr šíření $\phi = 35^\circ$



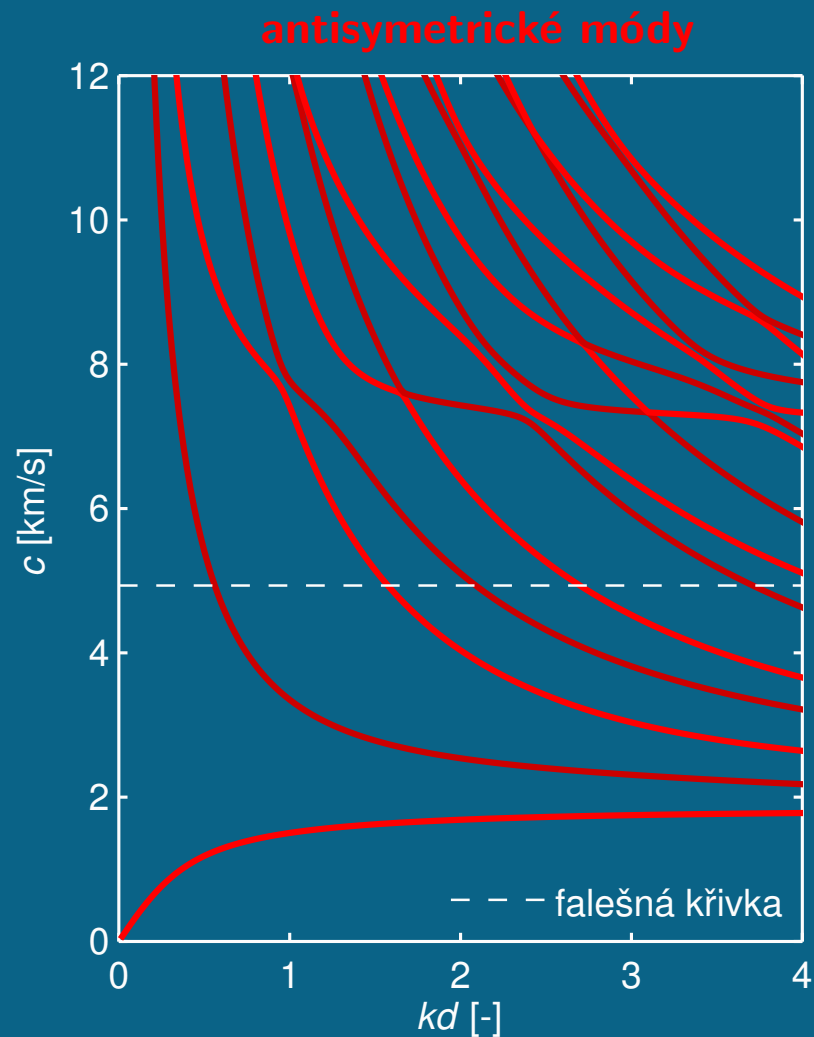
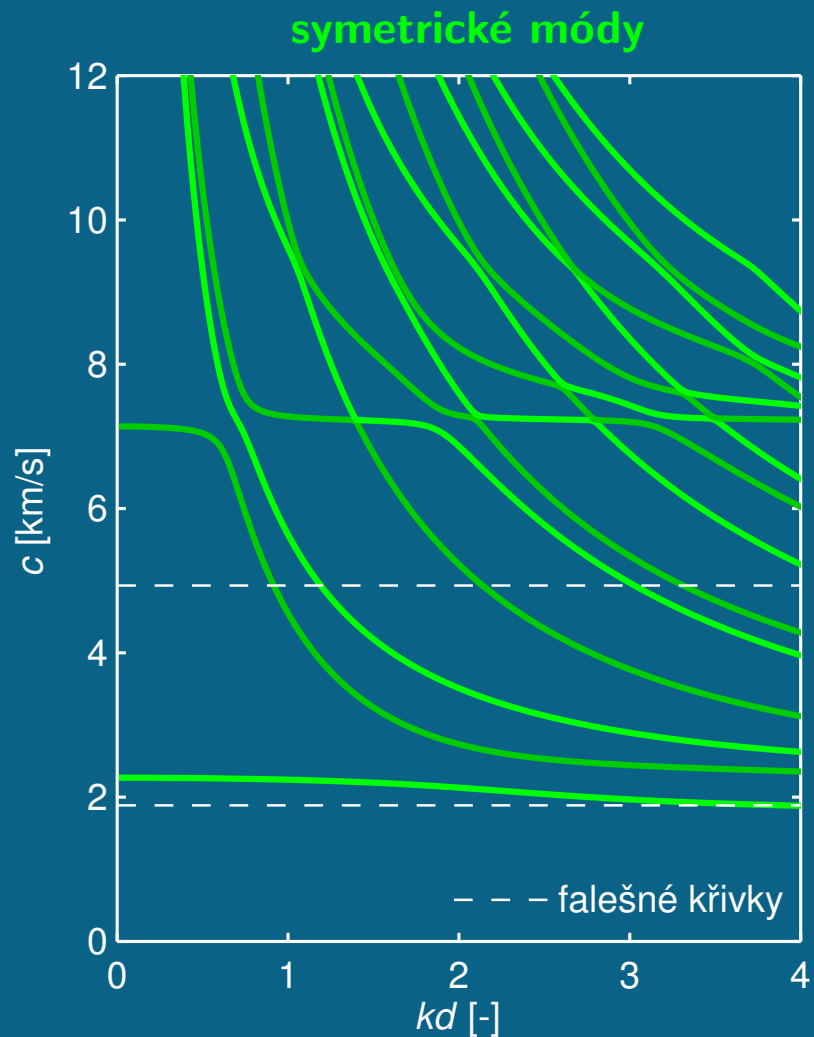
Směr šíření $\phi = 36^\circ$



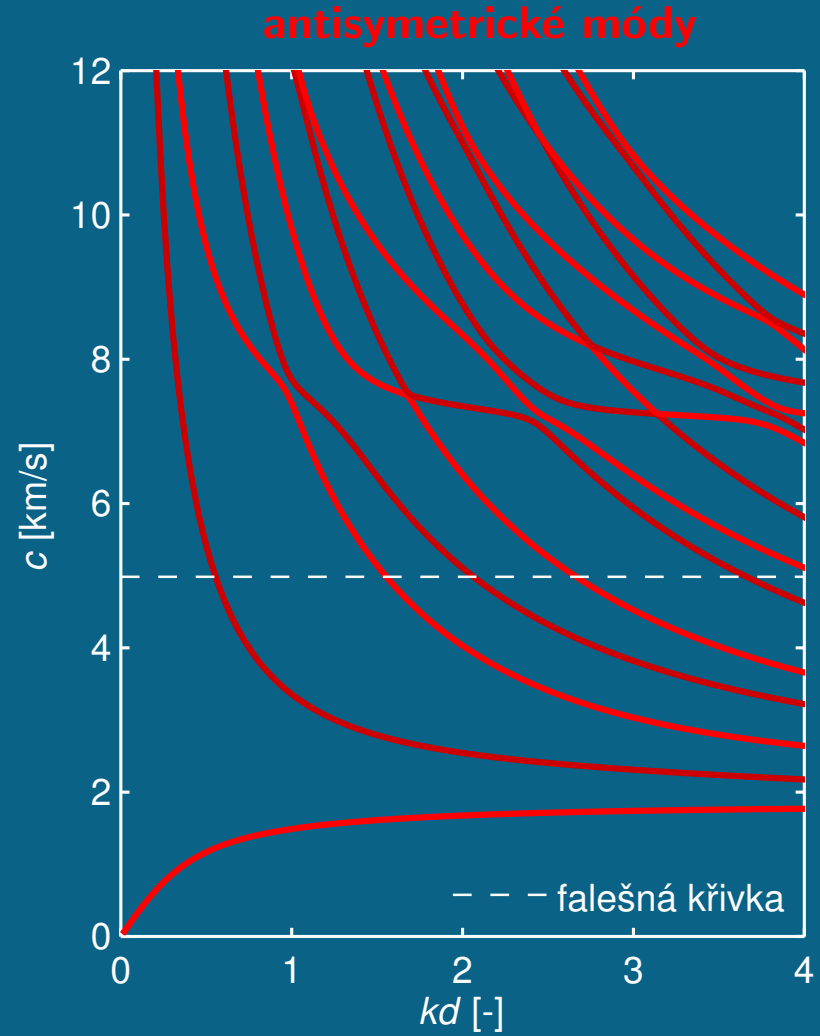
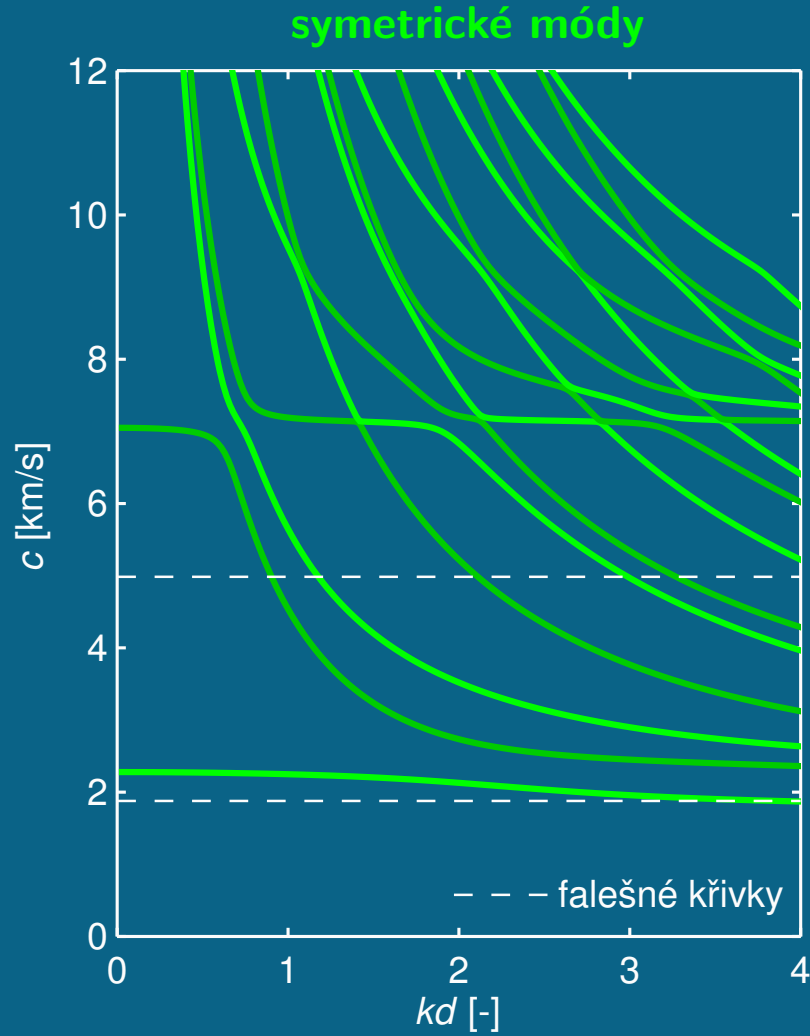
Směr šíření $\phi = 37^\circ$



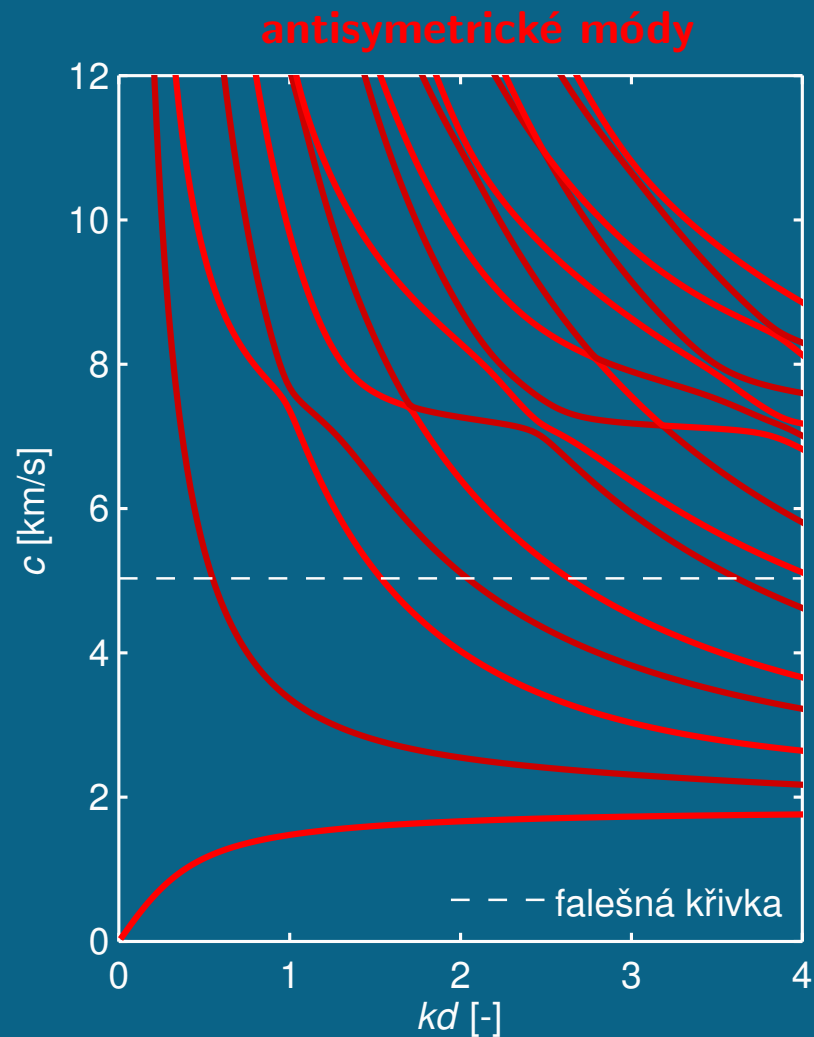
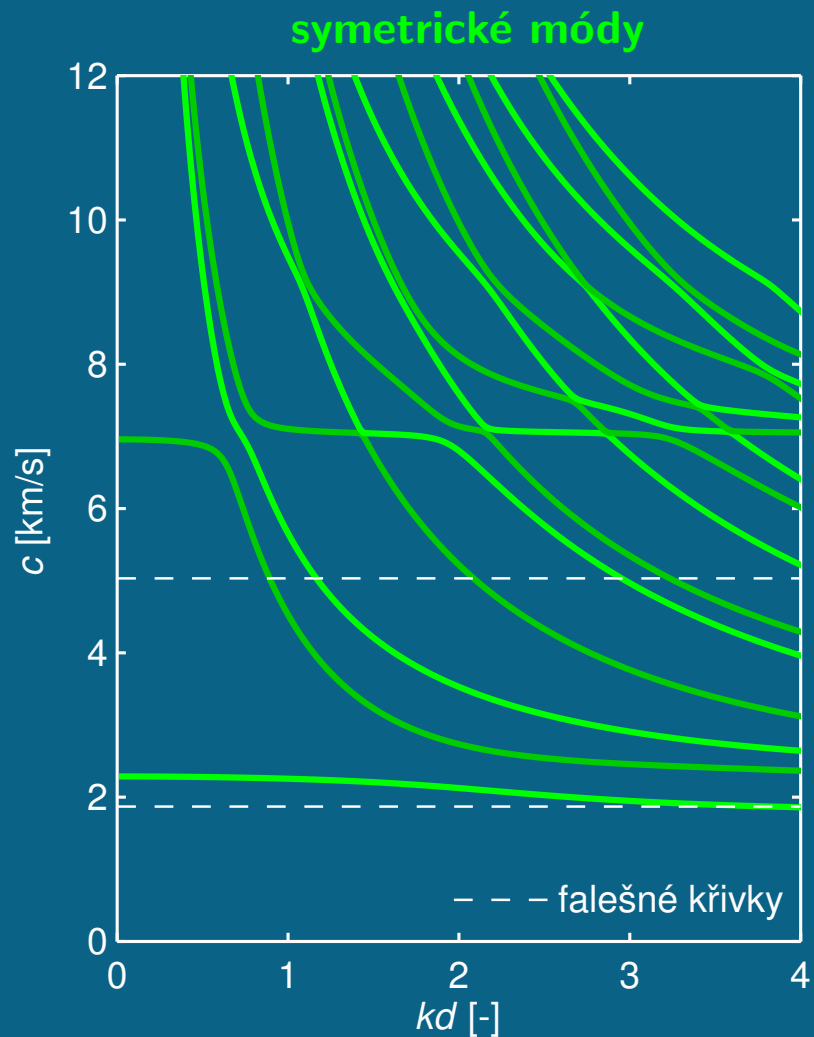
Směr šíření $\phi = 38^\circ$



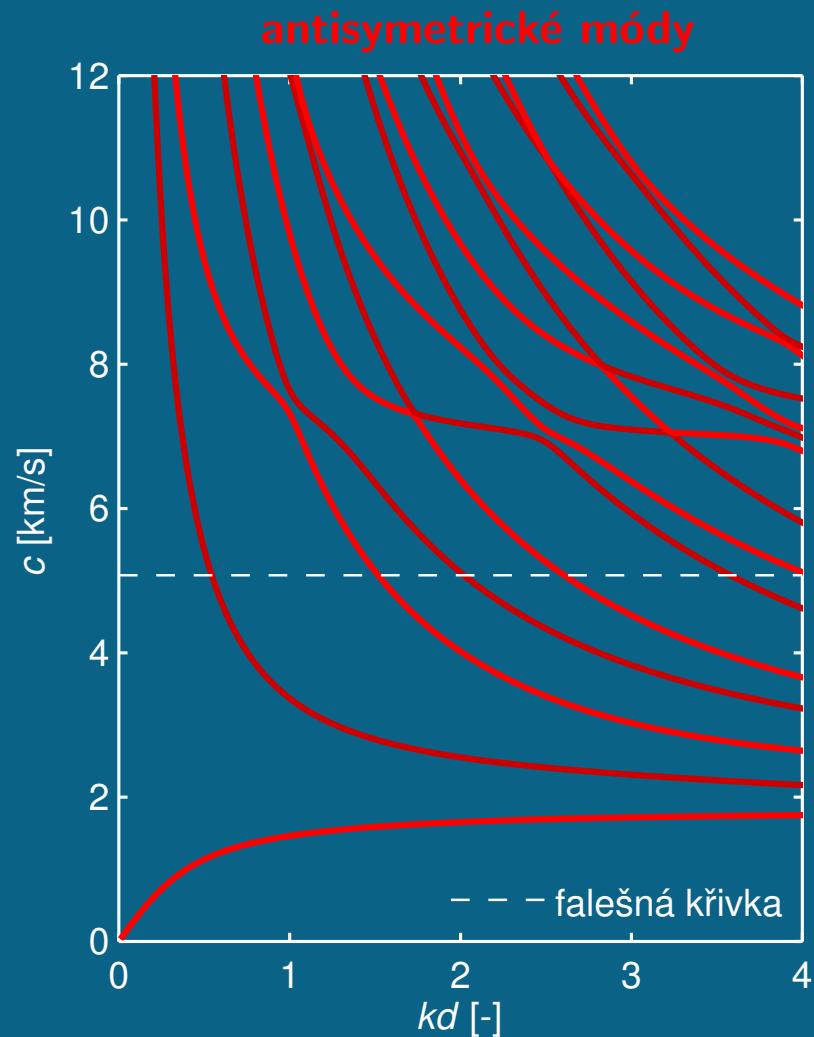
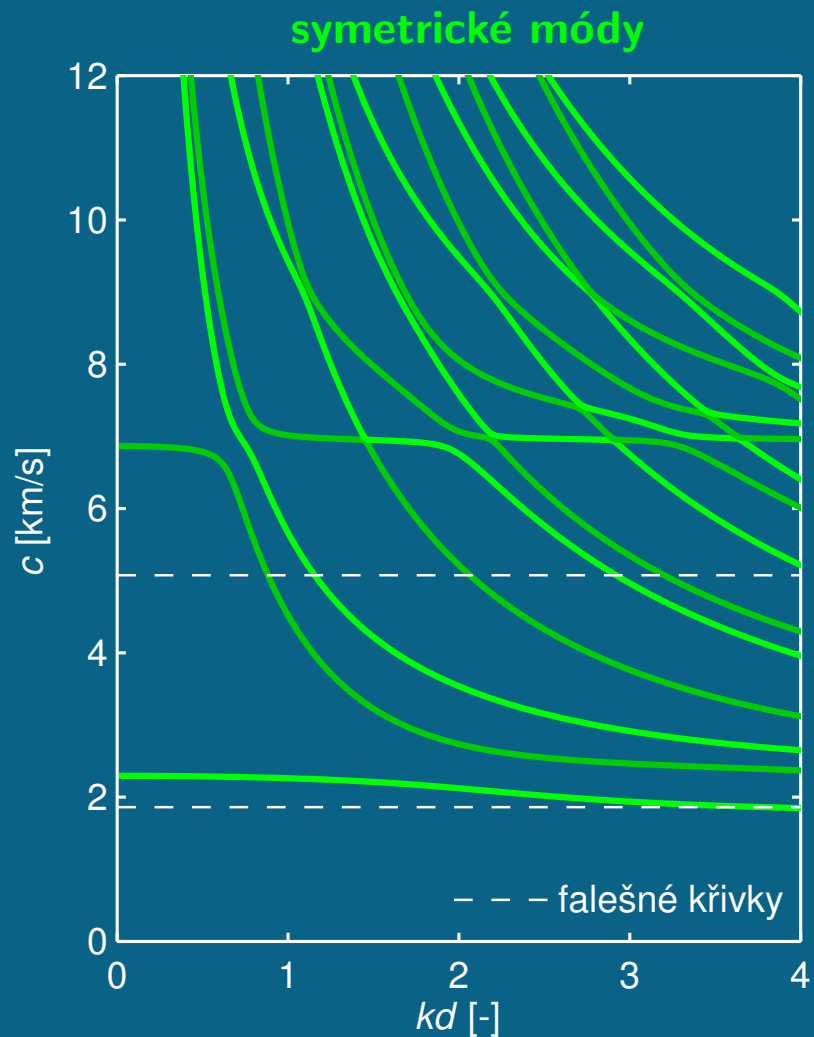
Směr šíření $\phi = 39^\circ$



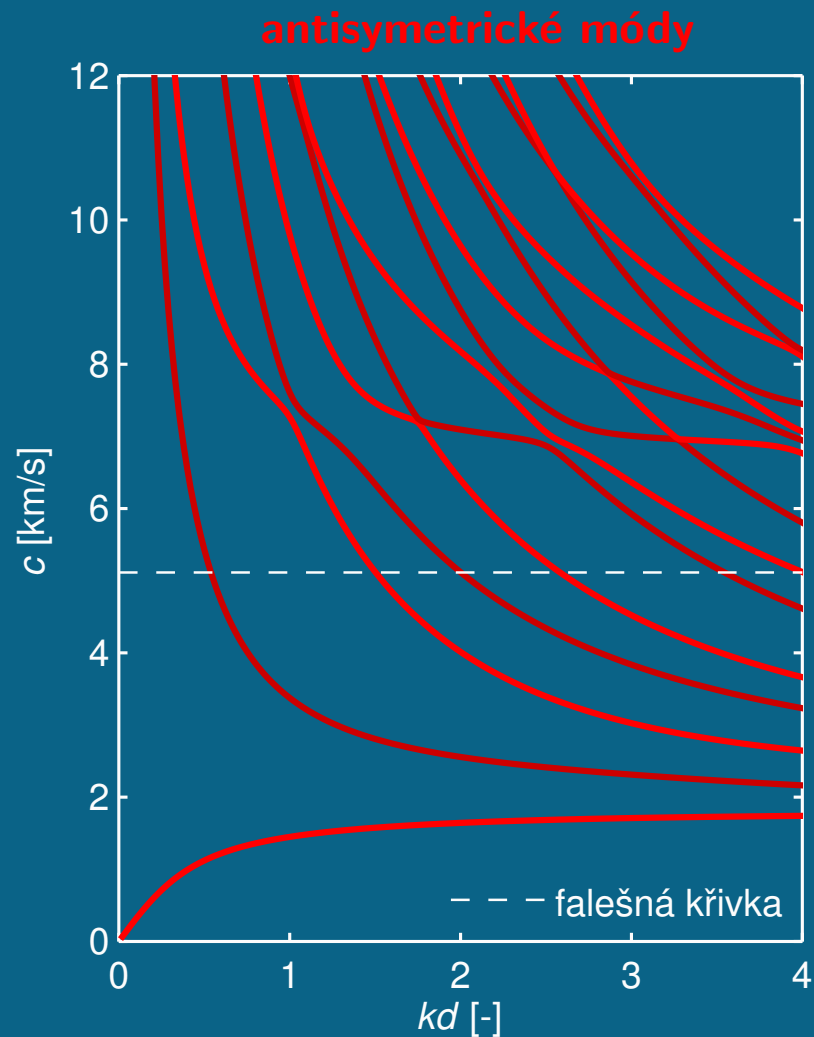
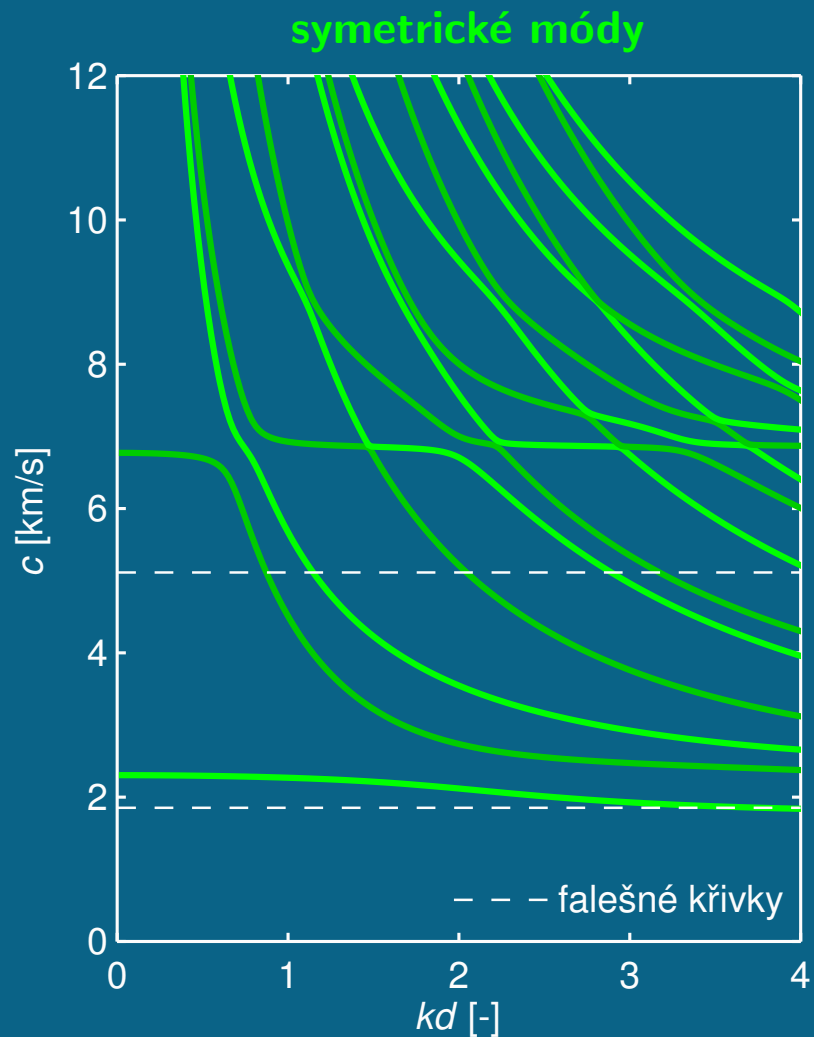
Směr šíření $\phi = 40^\circ$



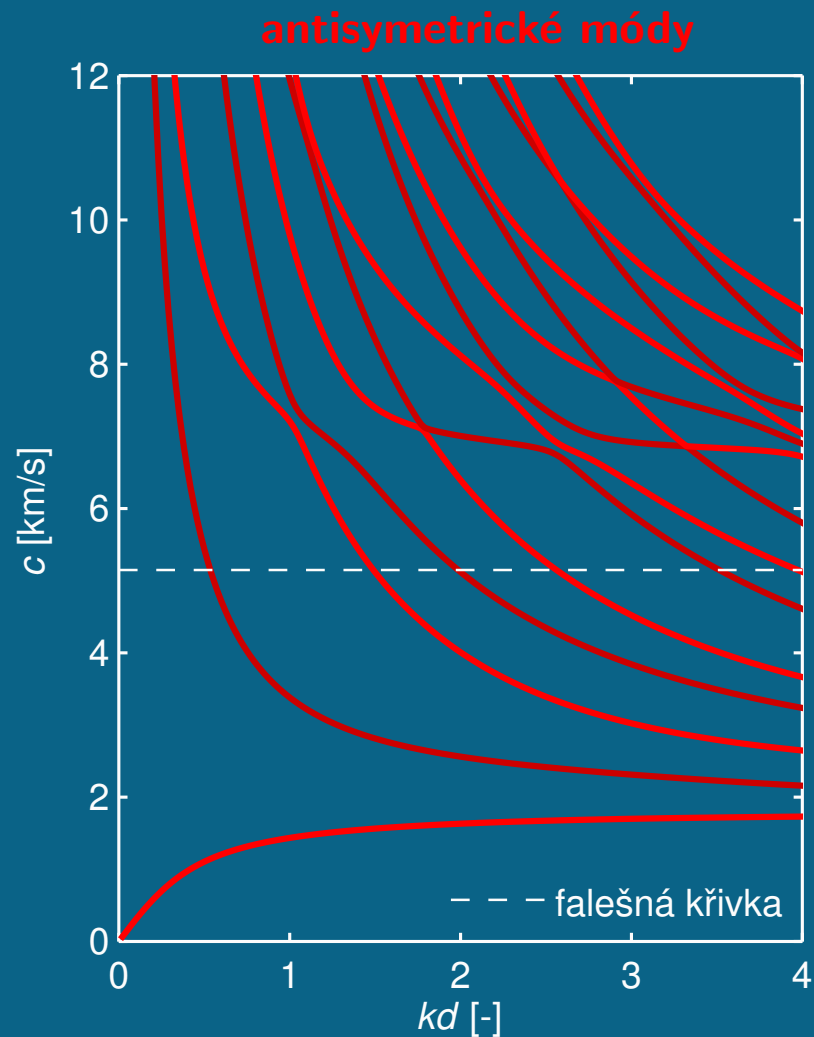
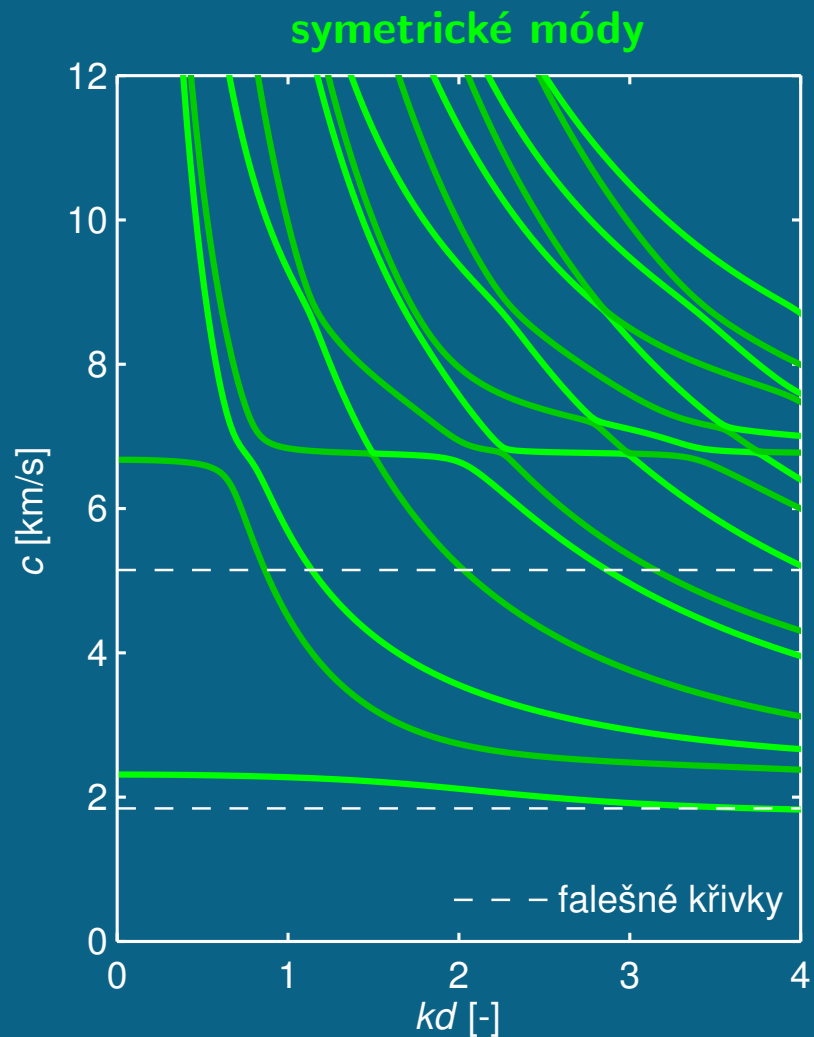
Směr šíření $\phi = 41^\circ$



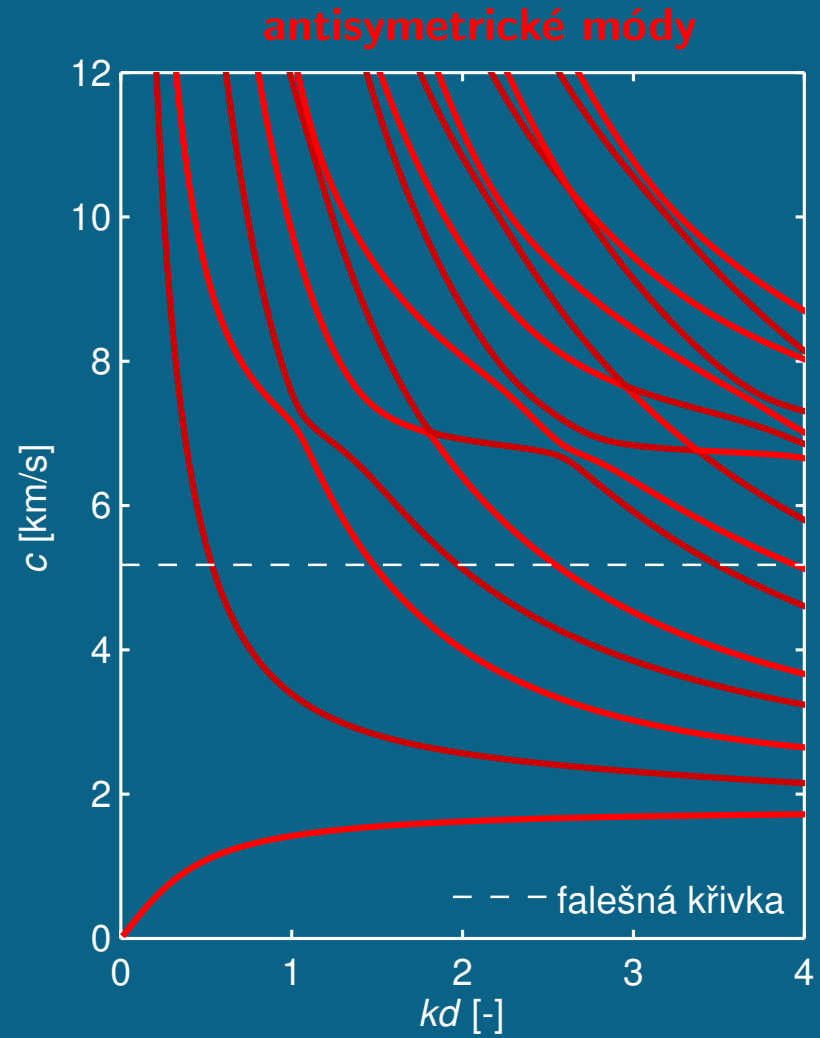
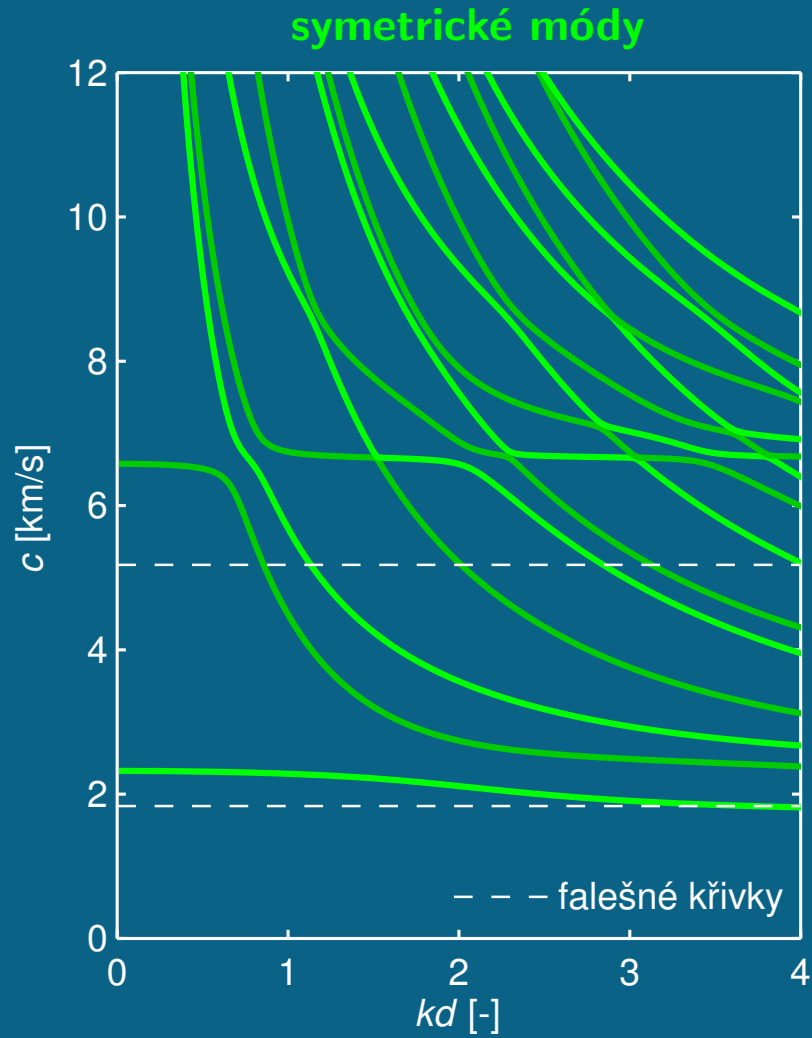
Směr šíření $\phi = 42^\circ$



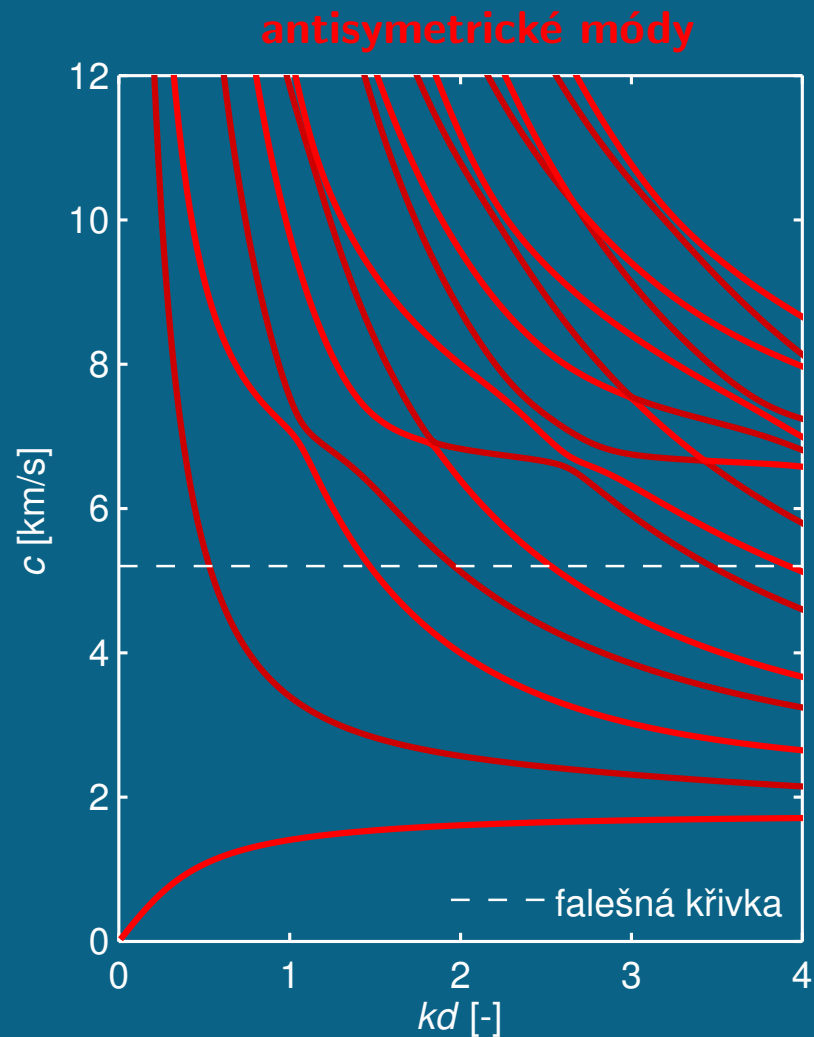
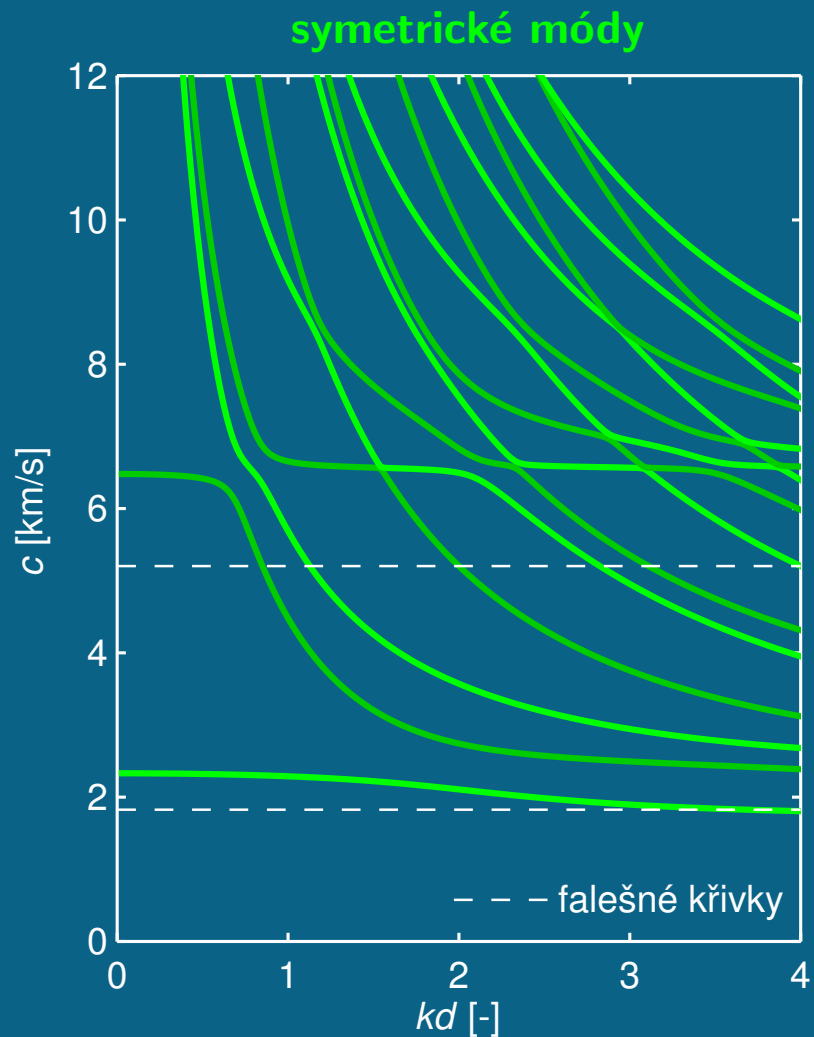
Směr šíření $\phi = 43^\circ$



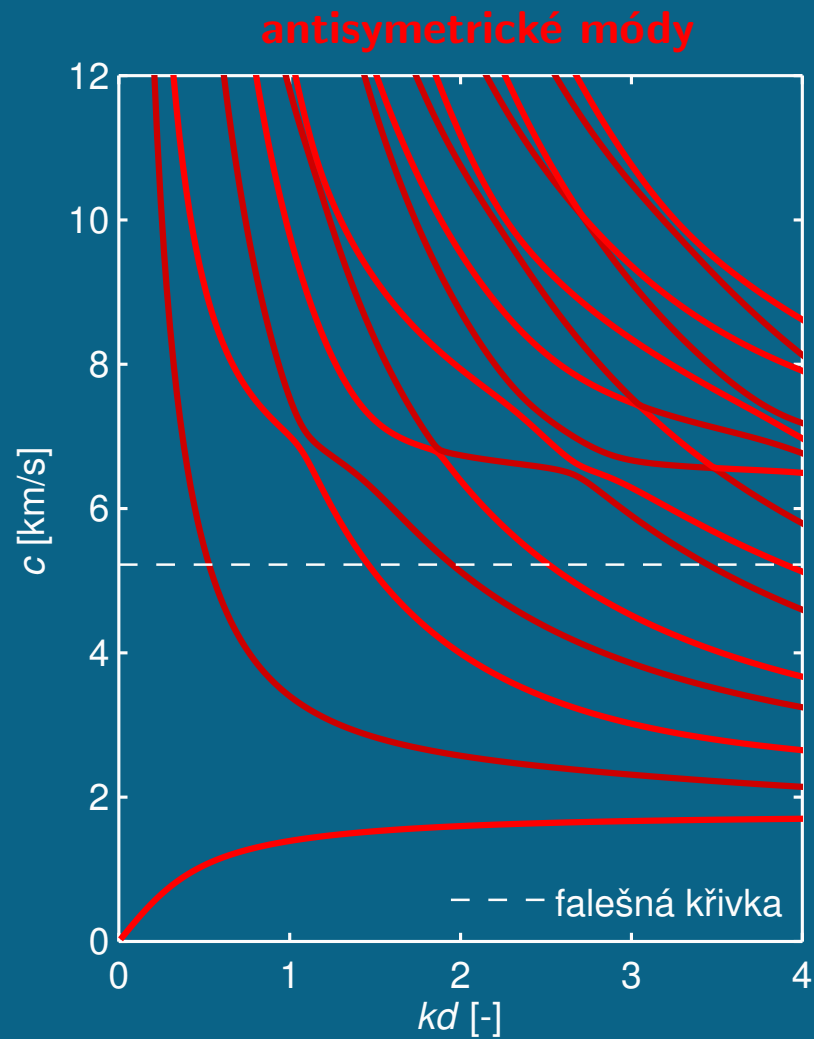
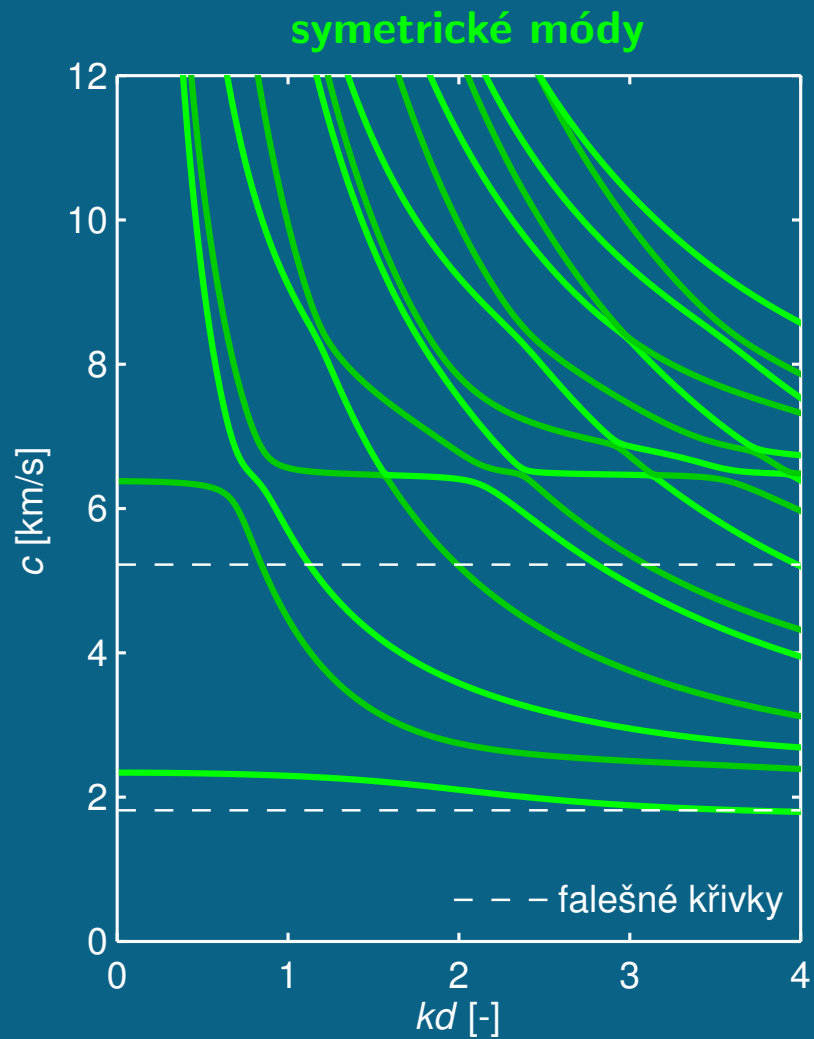
Směr šíření $\phi = 44^\circ$



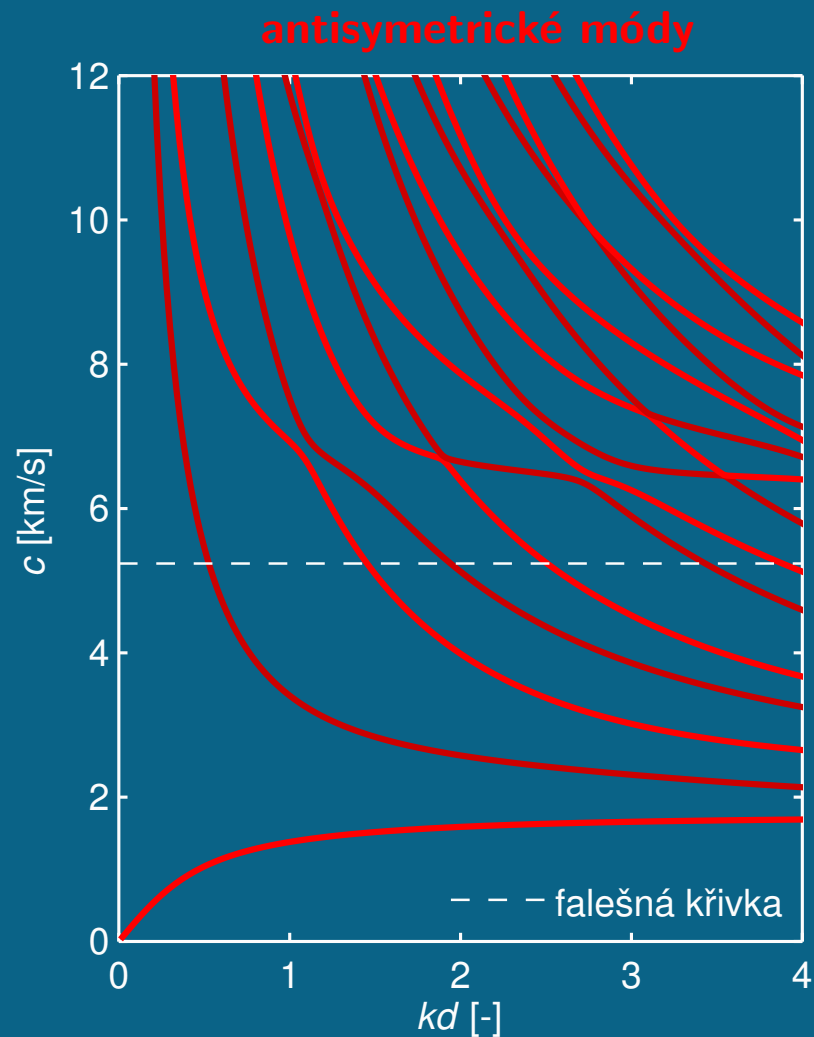
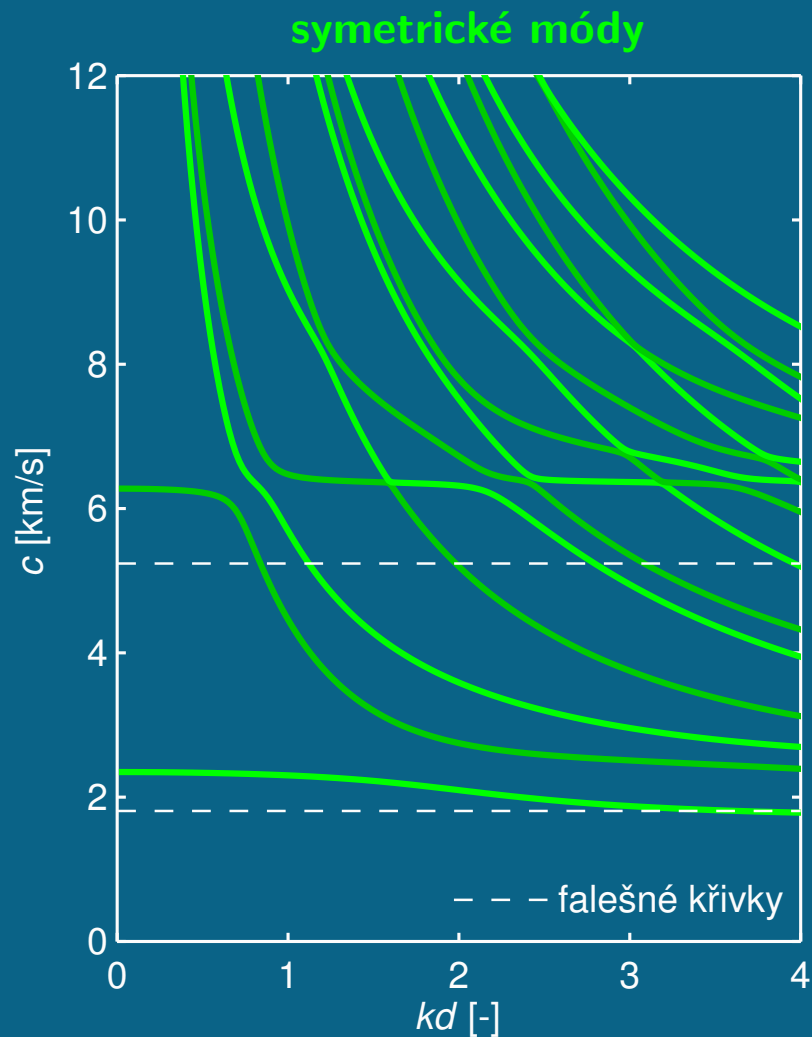
Směr šíření $\phi = 45^\circ$



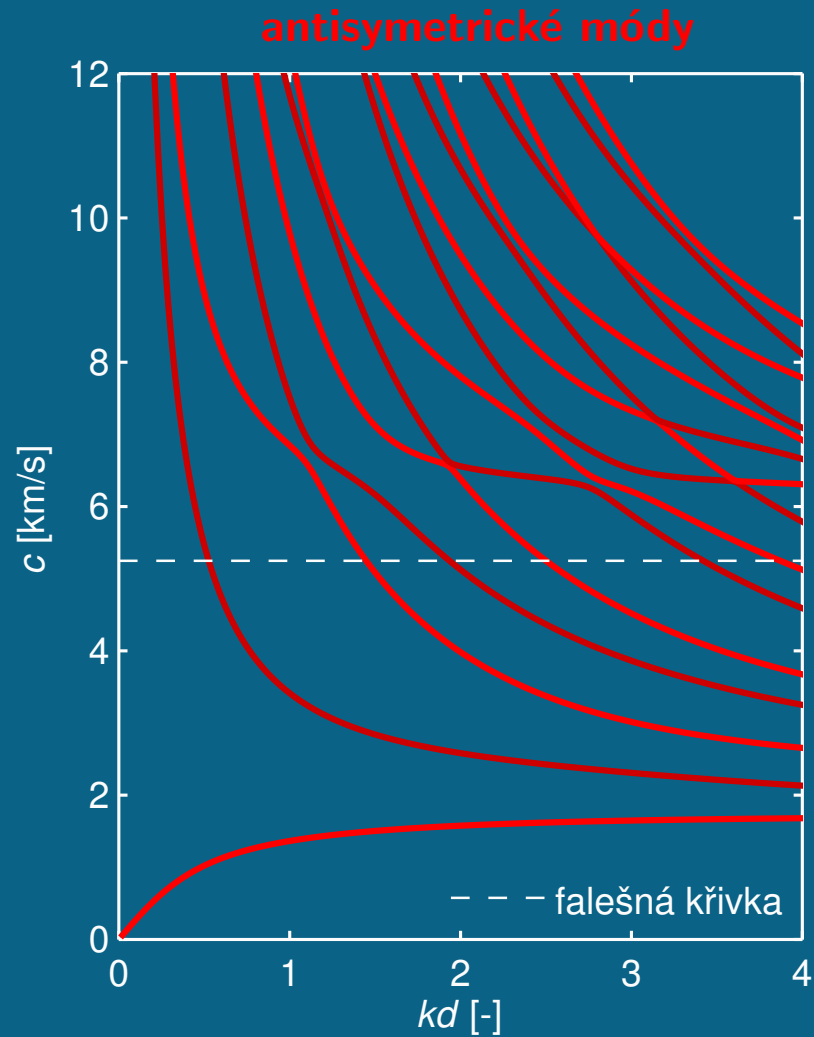
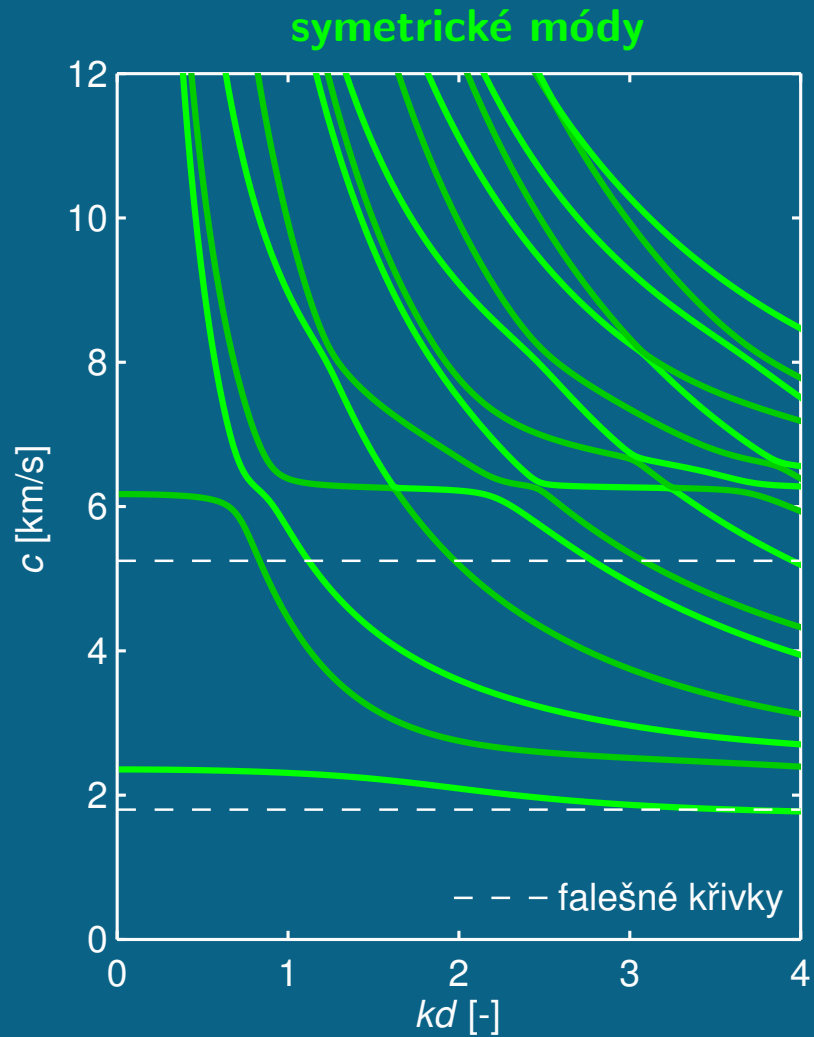
Směr šíření $\phi = 46^\circ$



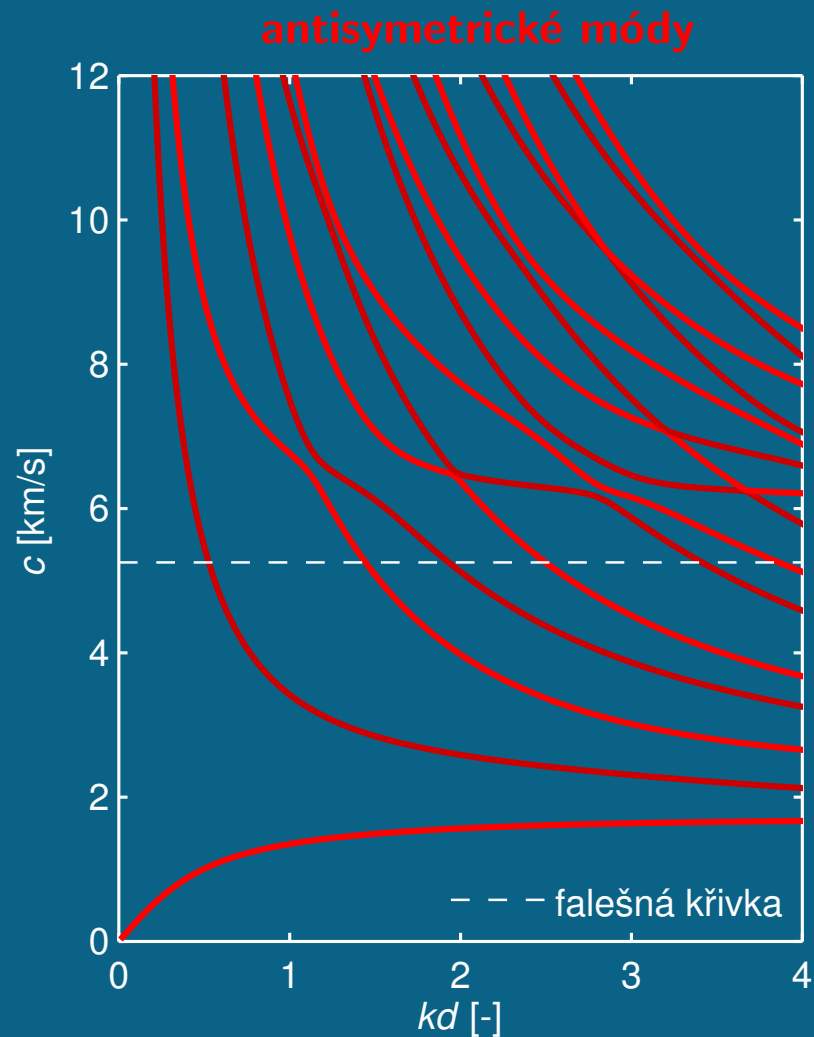
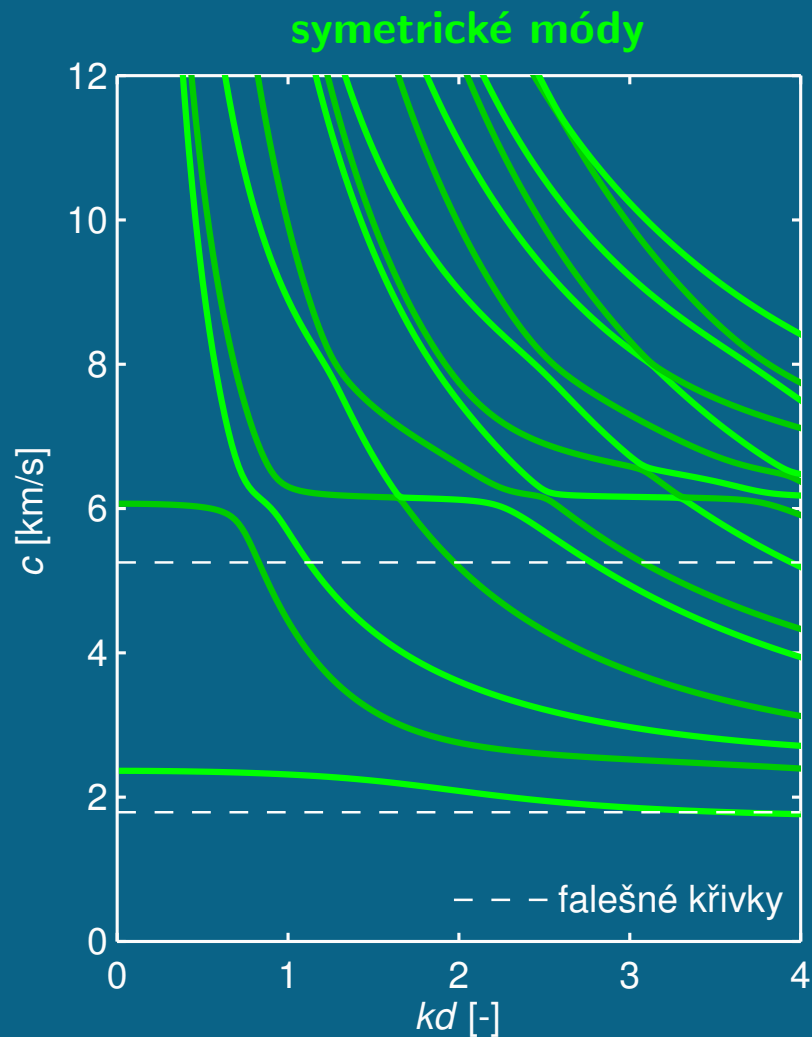
Směr šíření $\phi = 47^\circ$



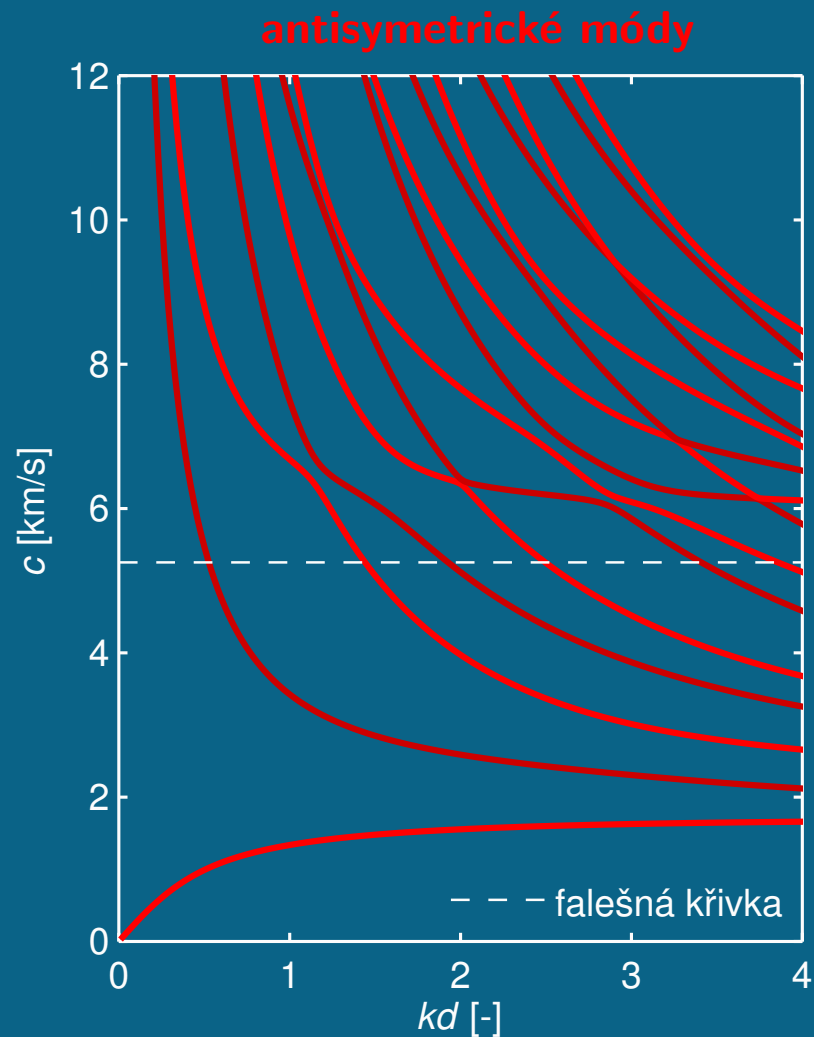
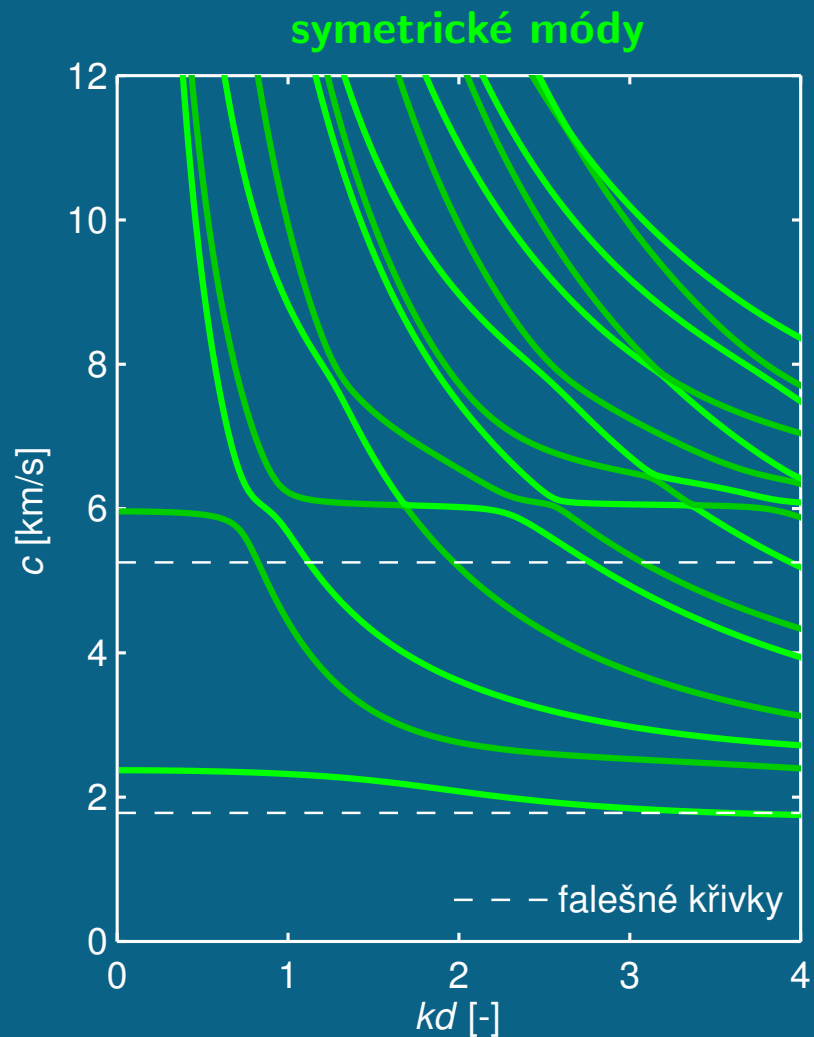
Směr šíření $\phi = 48^\circ$



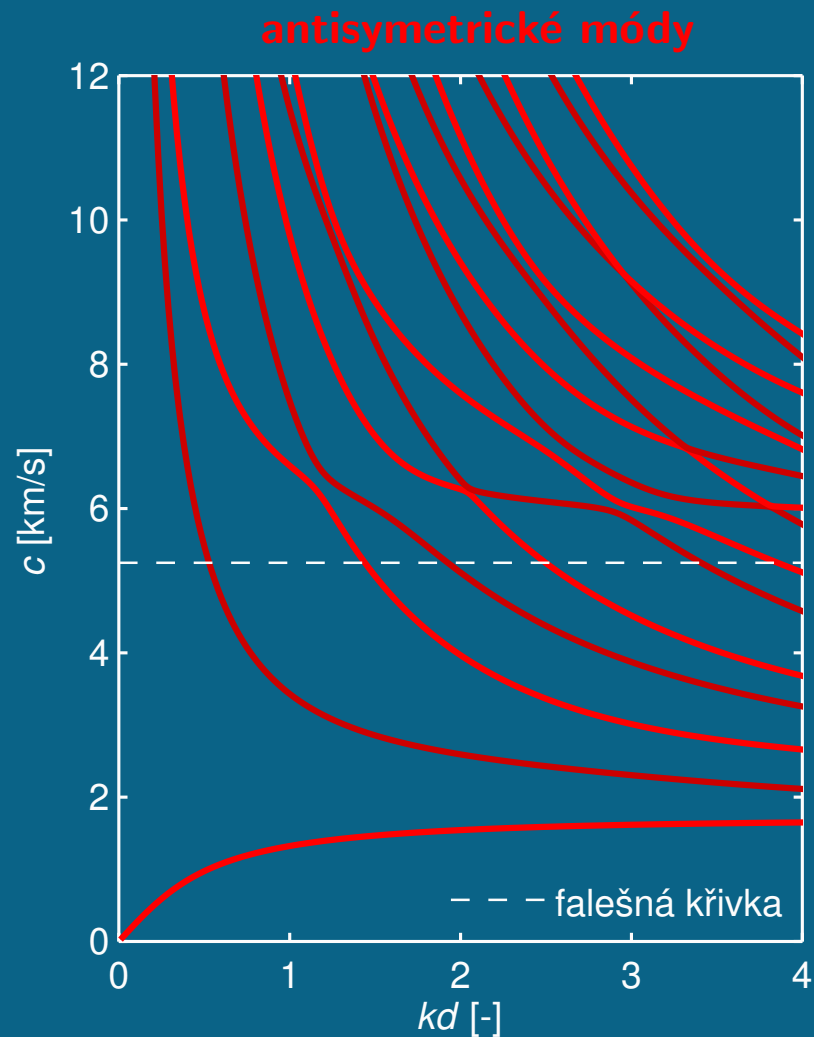
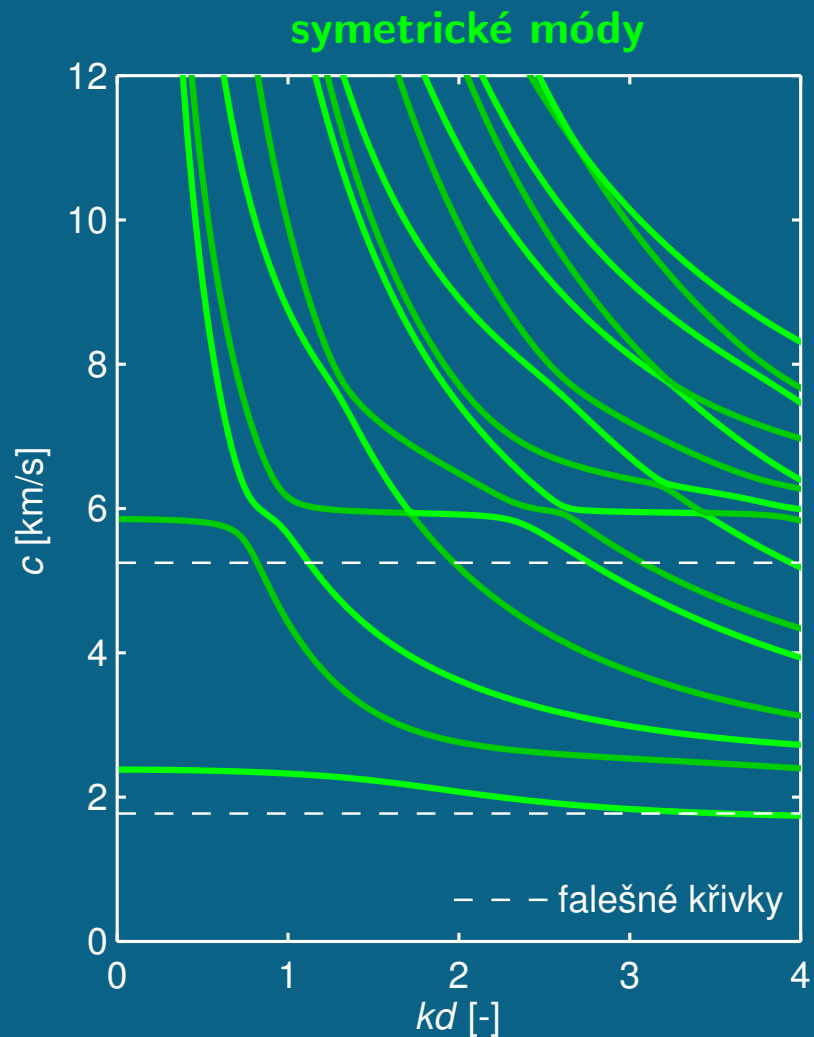
Směr šíření $\phi = 49^\circ$



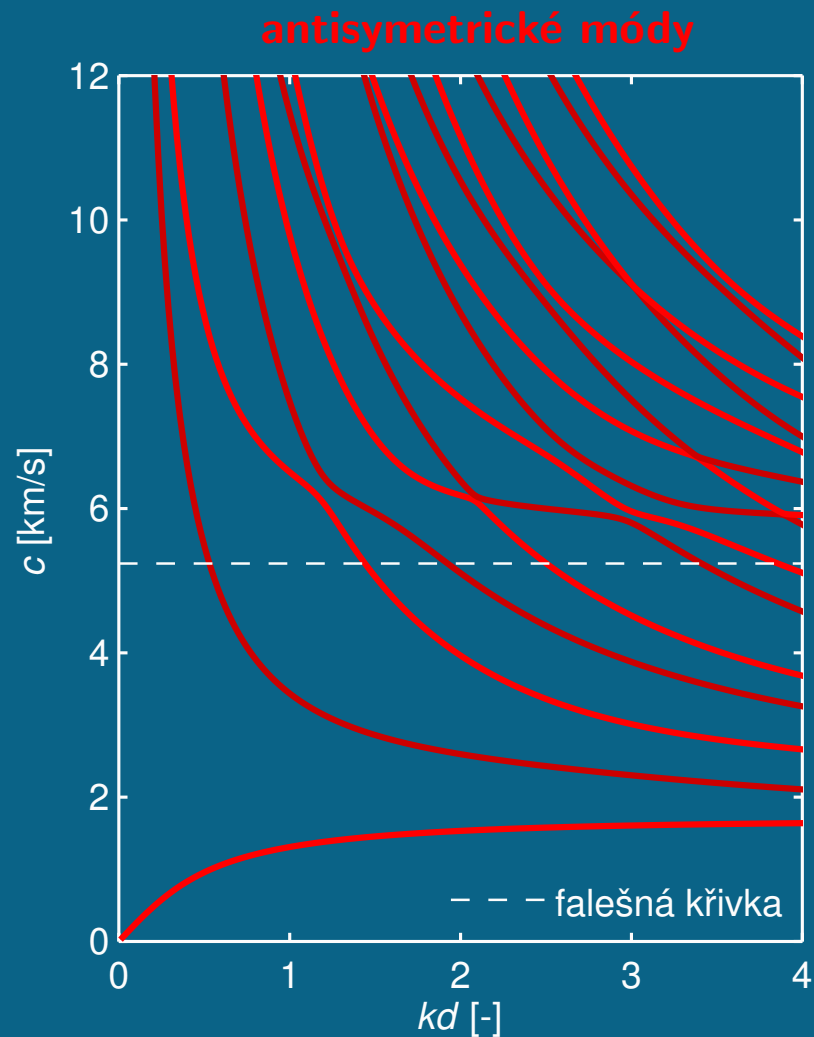
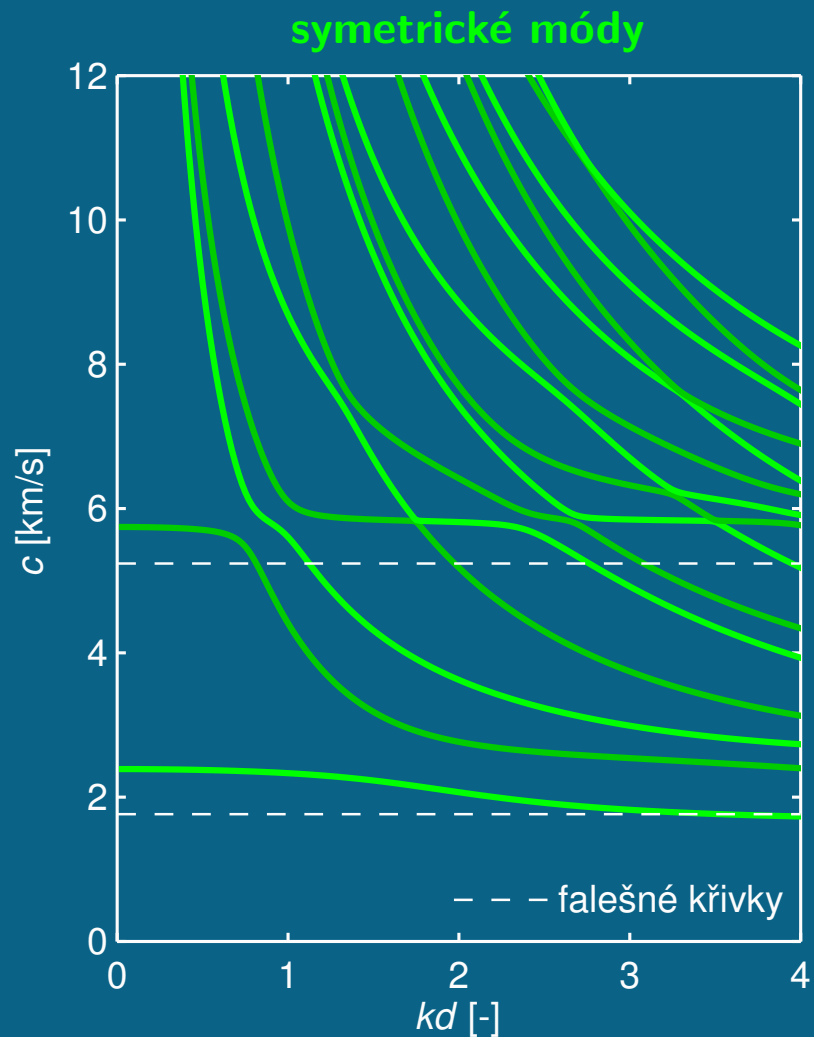
Směr šíření $\phi = 50^\circ$



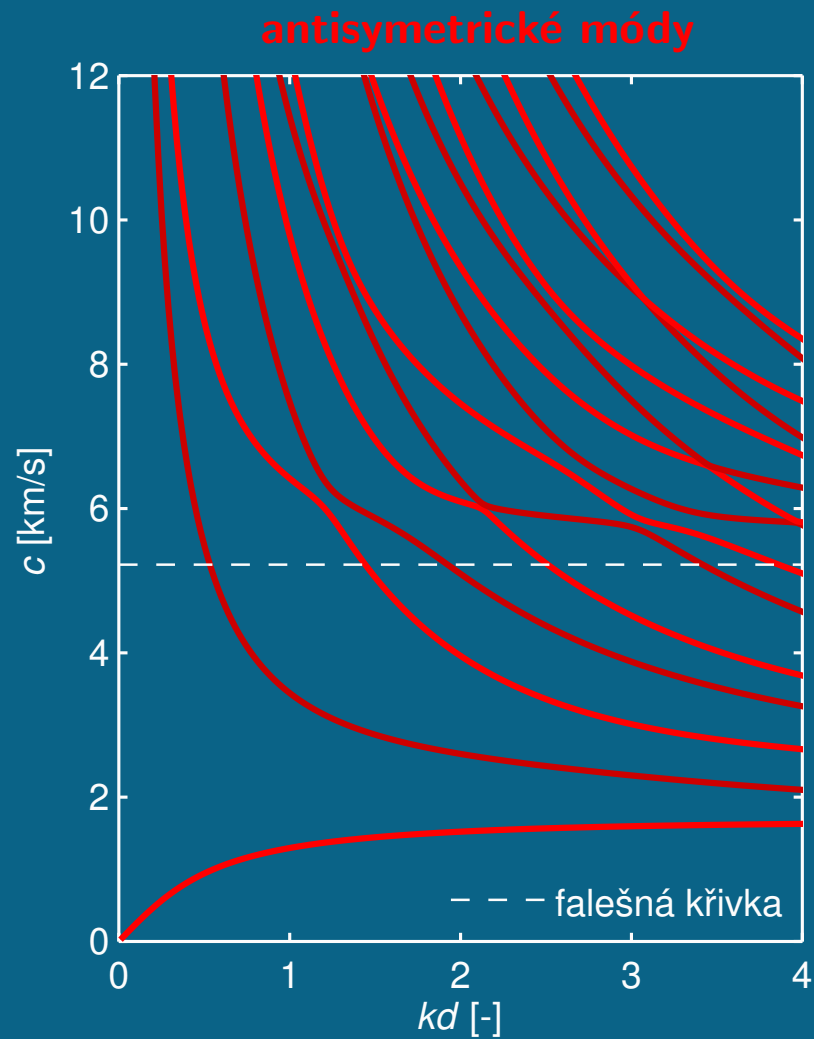
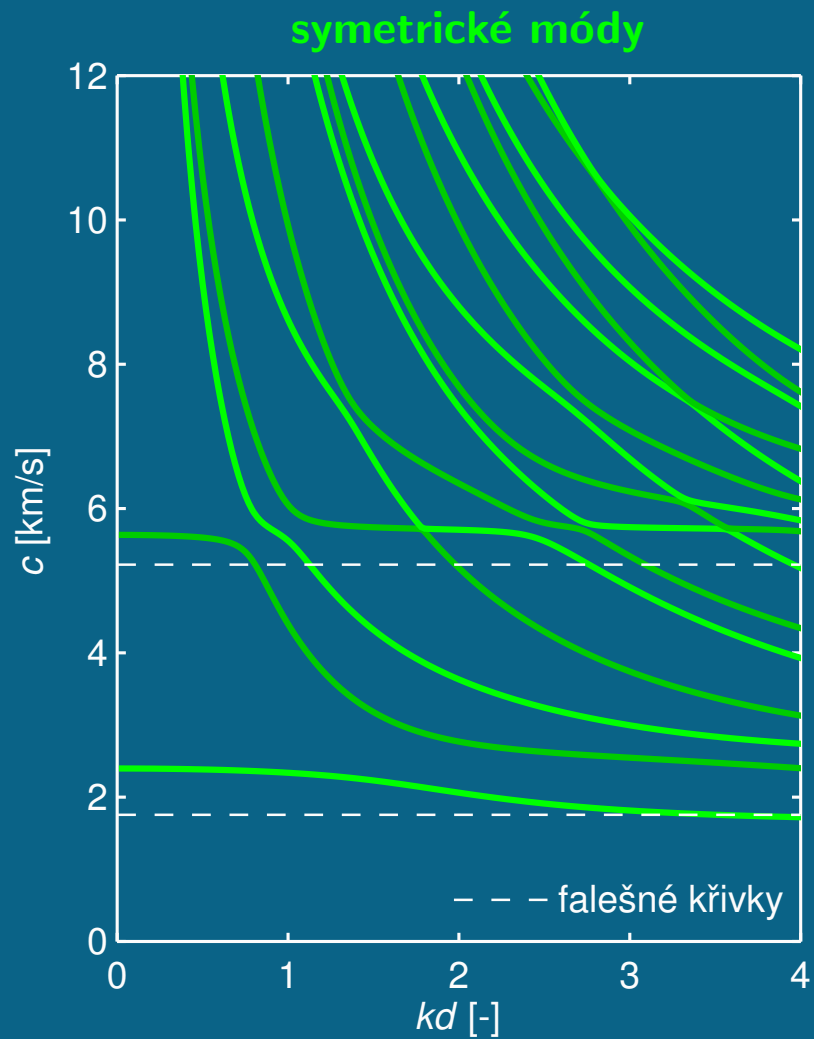
Směr šíření $\phi = 51^\circ$



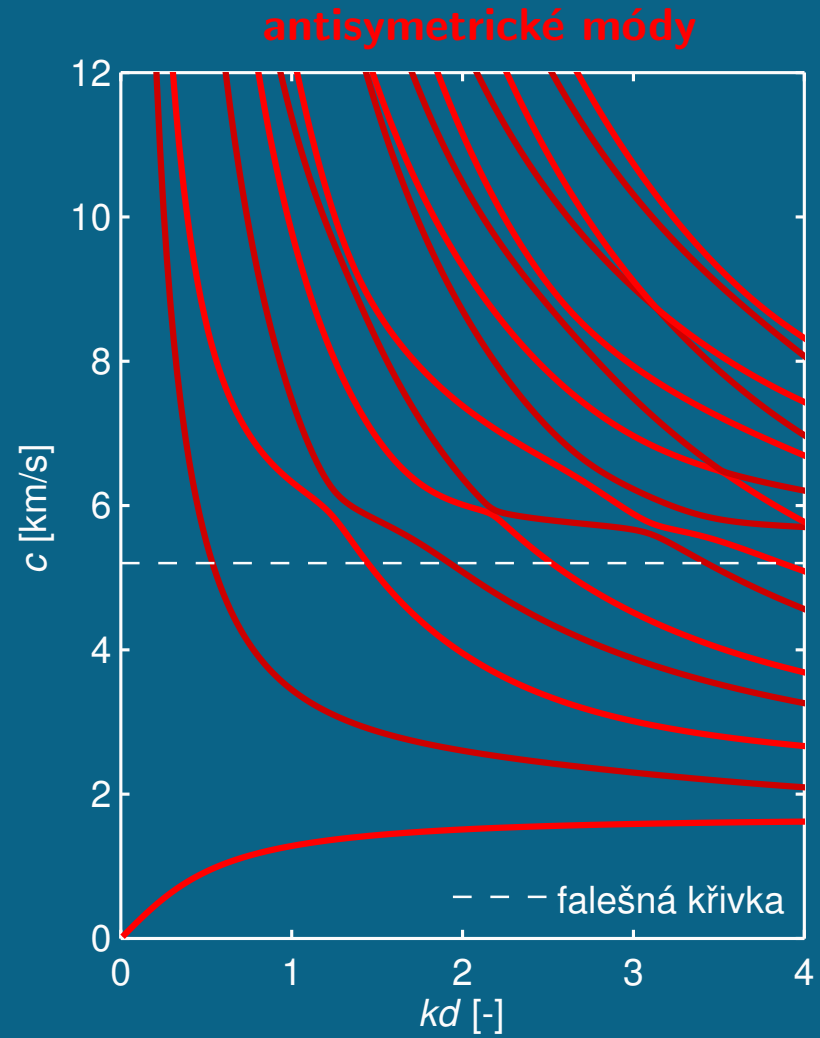
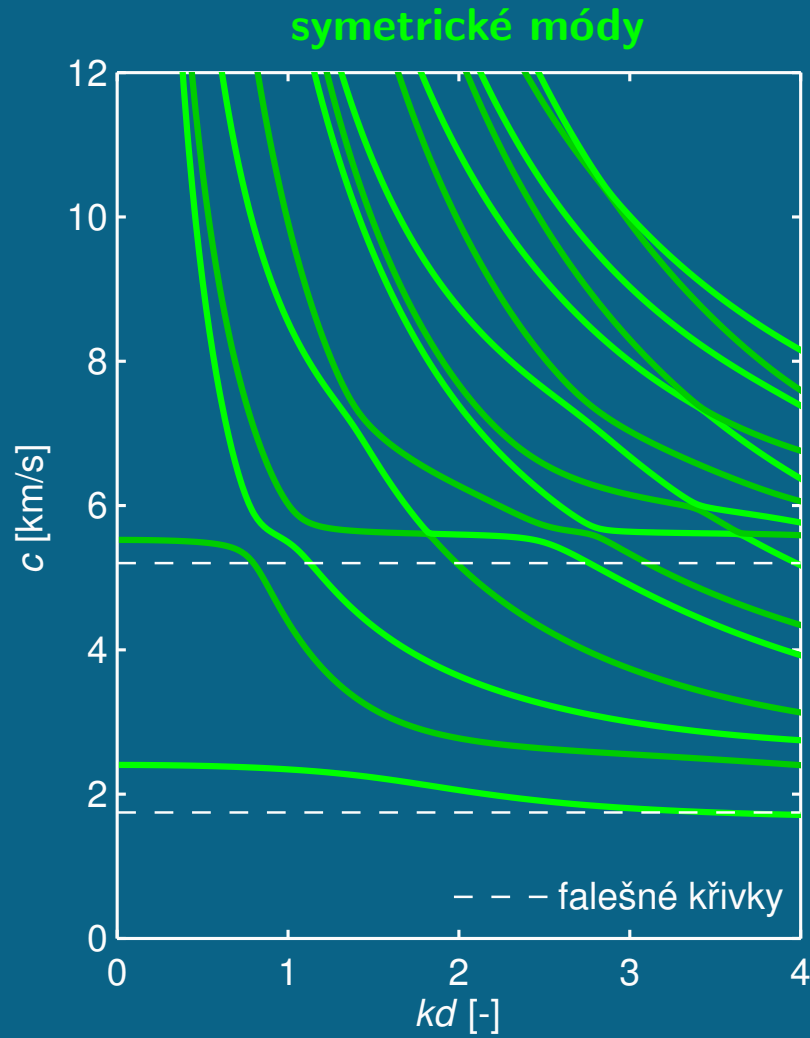
Směr šíření $\phi = 52^\circ$



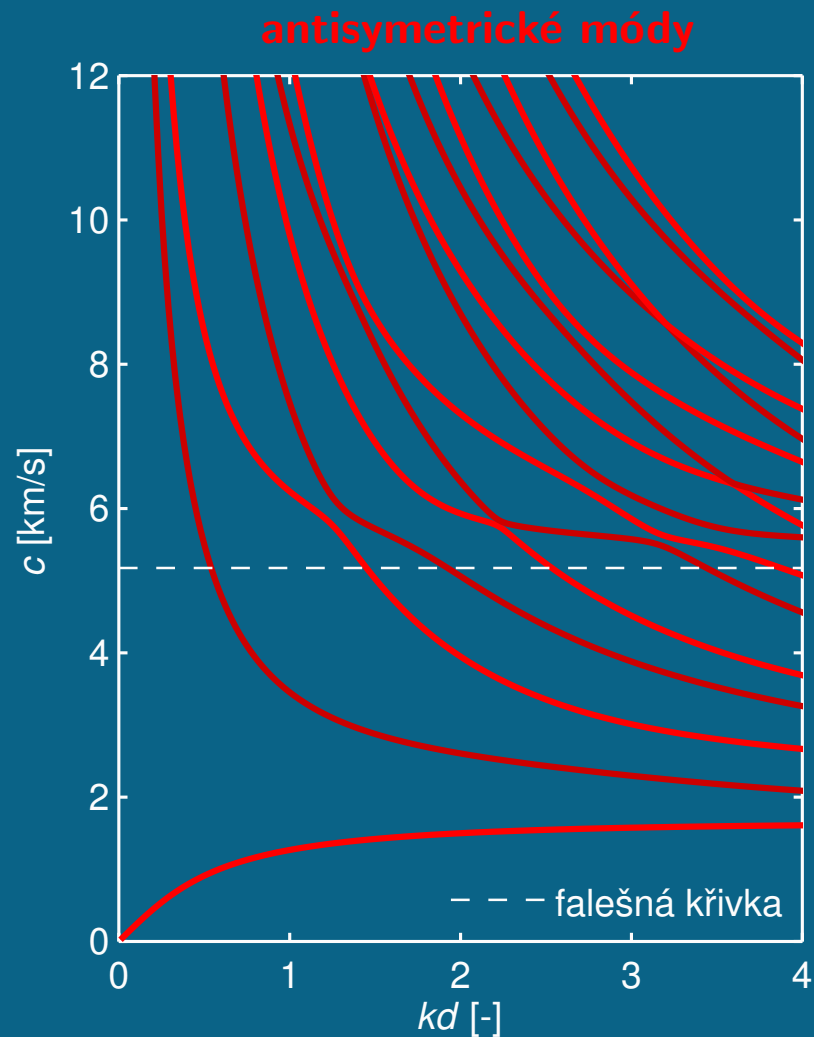
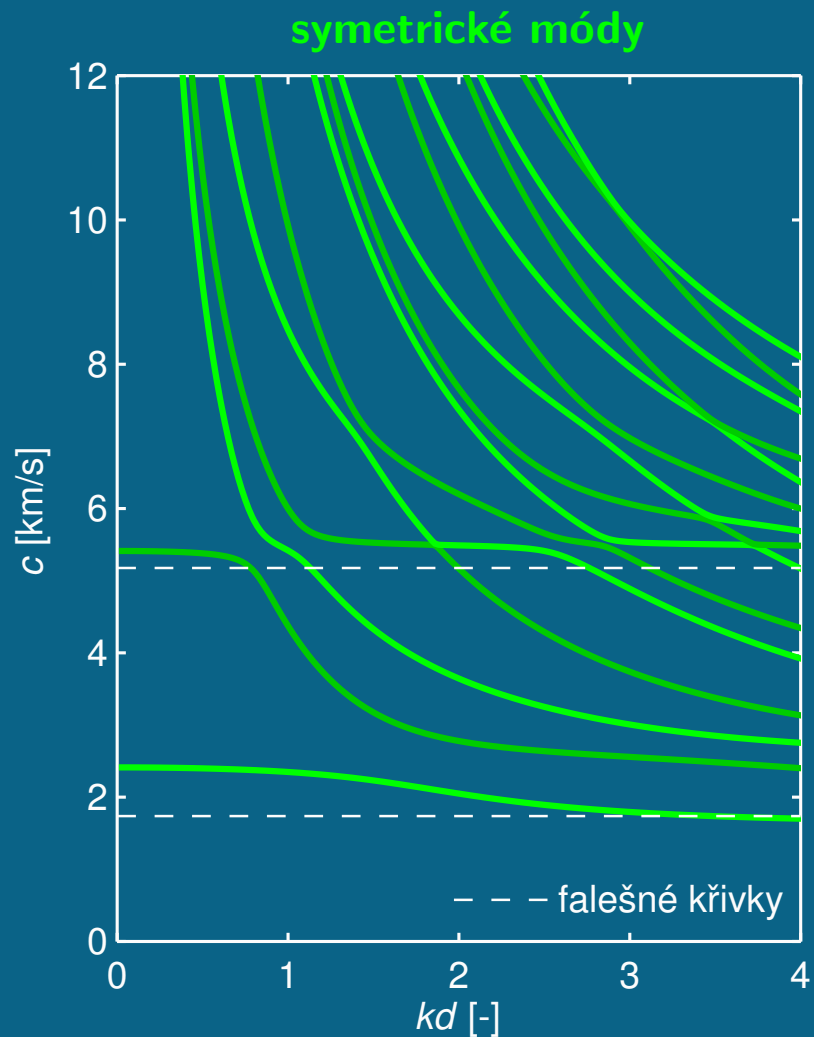
Směr šíření $\phi = 53^\circ$



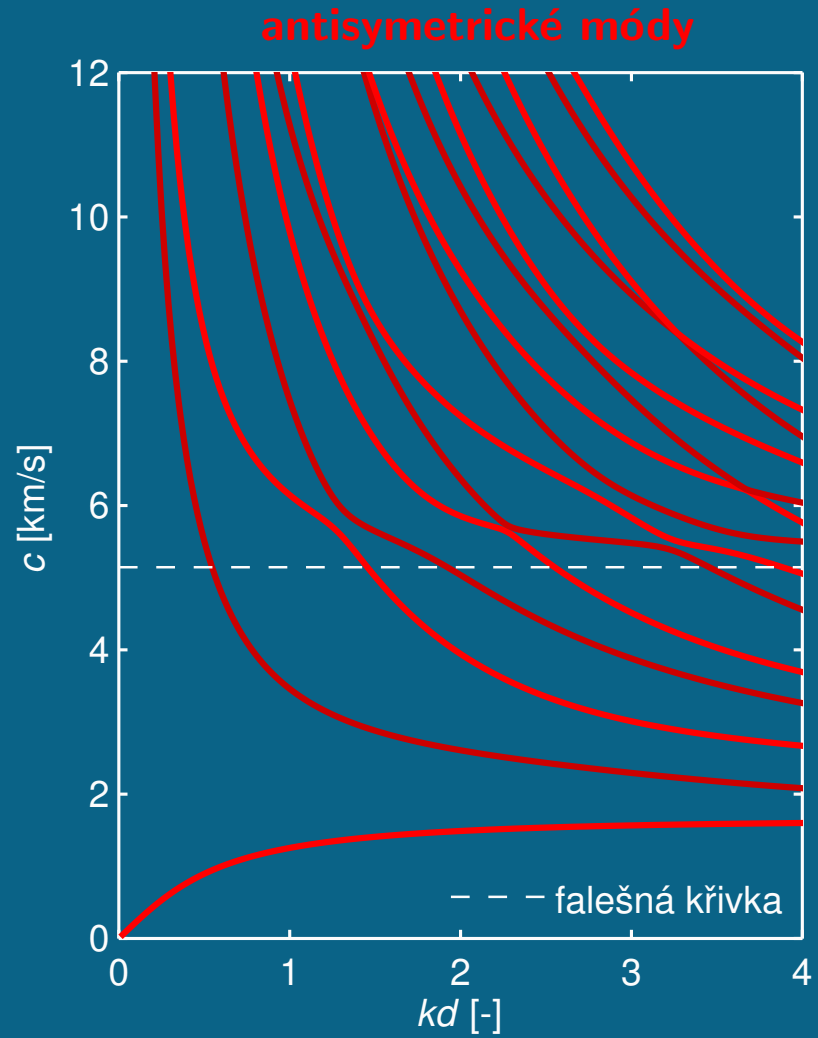
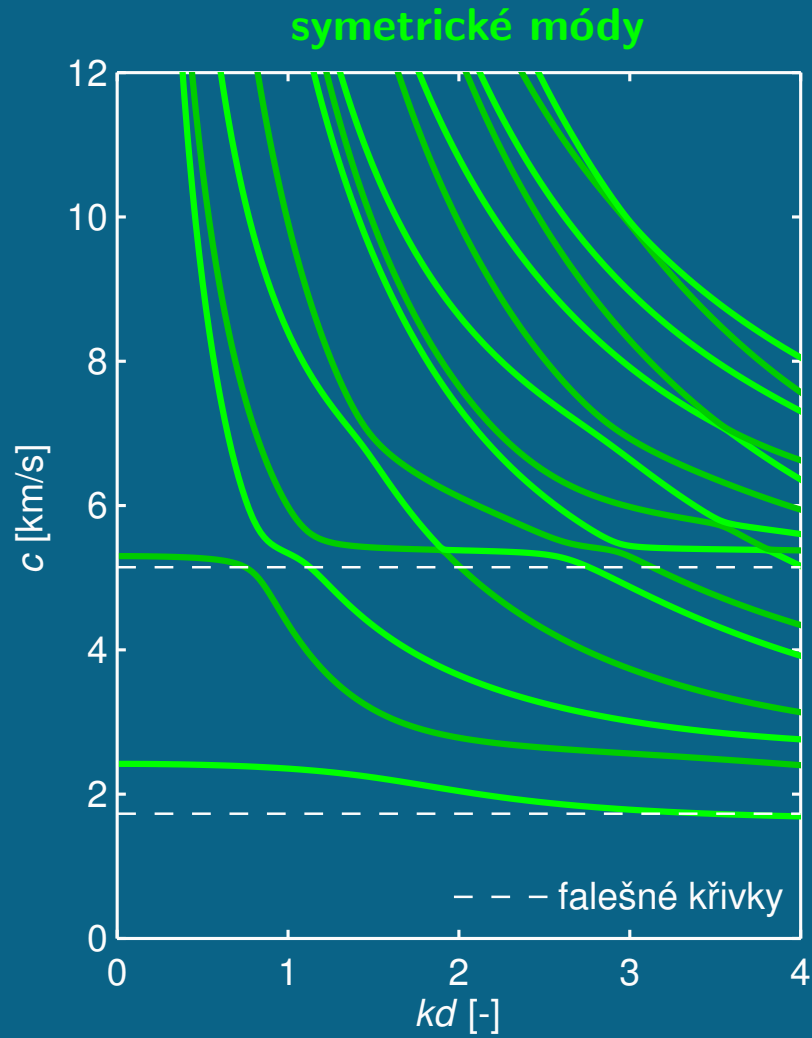
Směr šíření $\phi = 54^\circ$



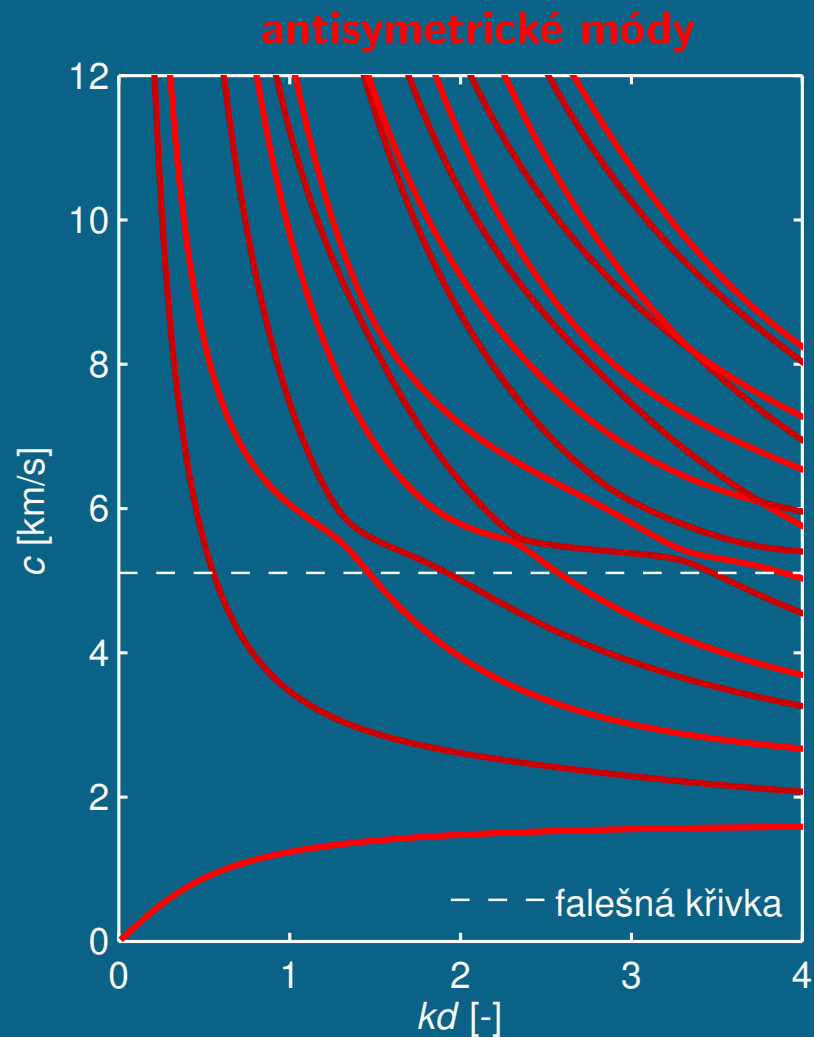
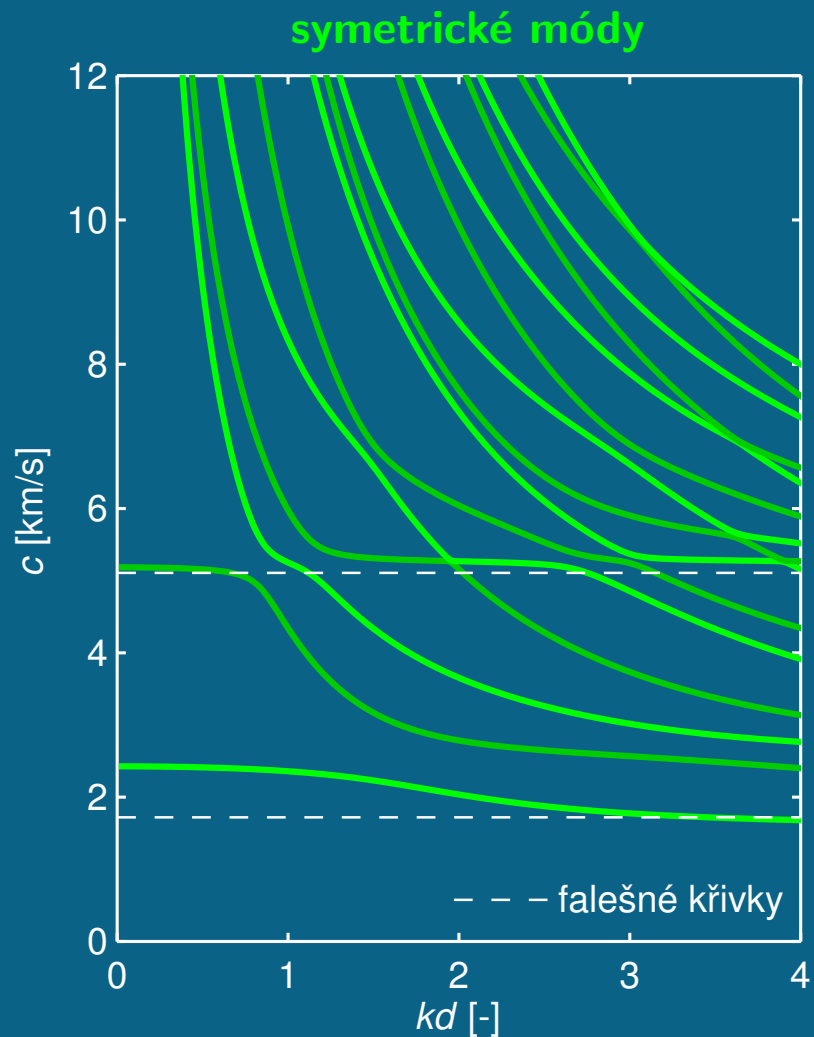
Směr šíření $\phi = 55^\circ$



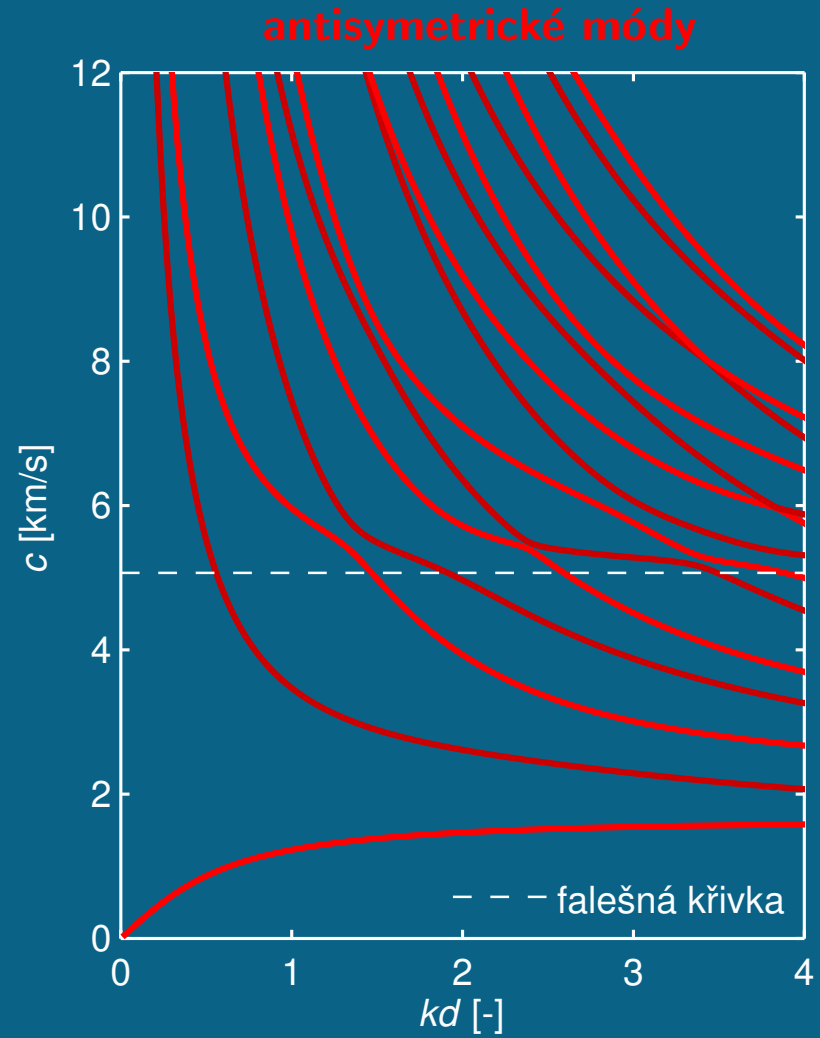
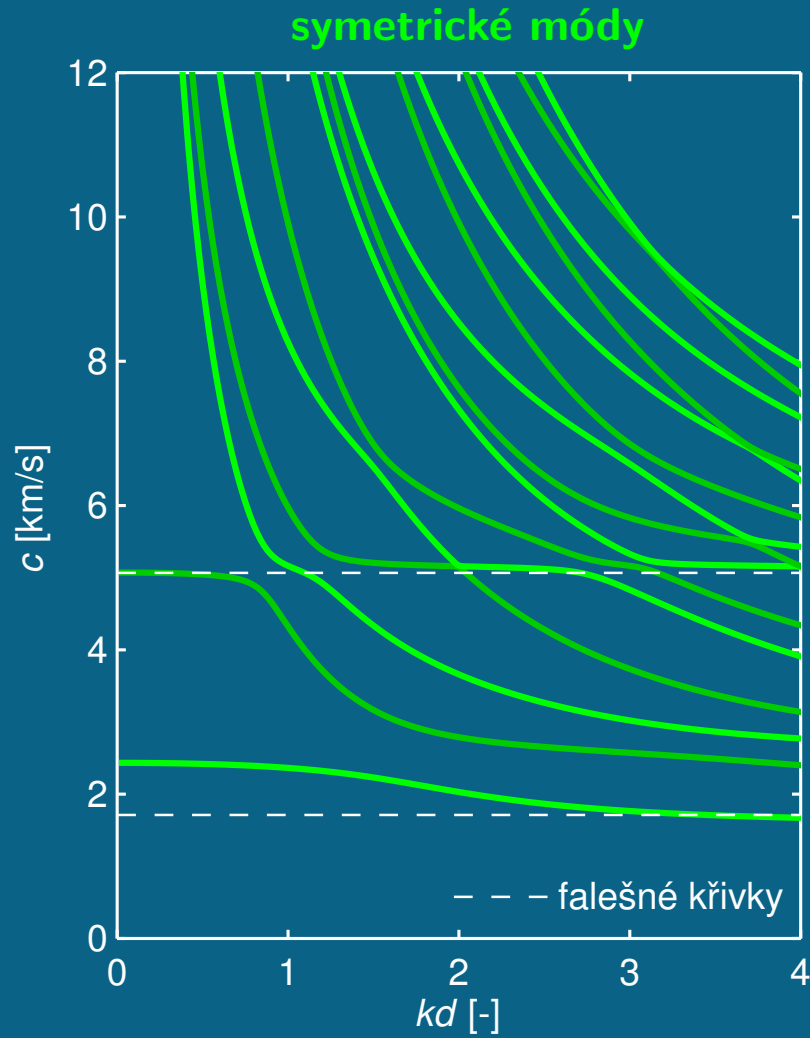
Směr šíření $\phi = 56^\circ$



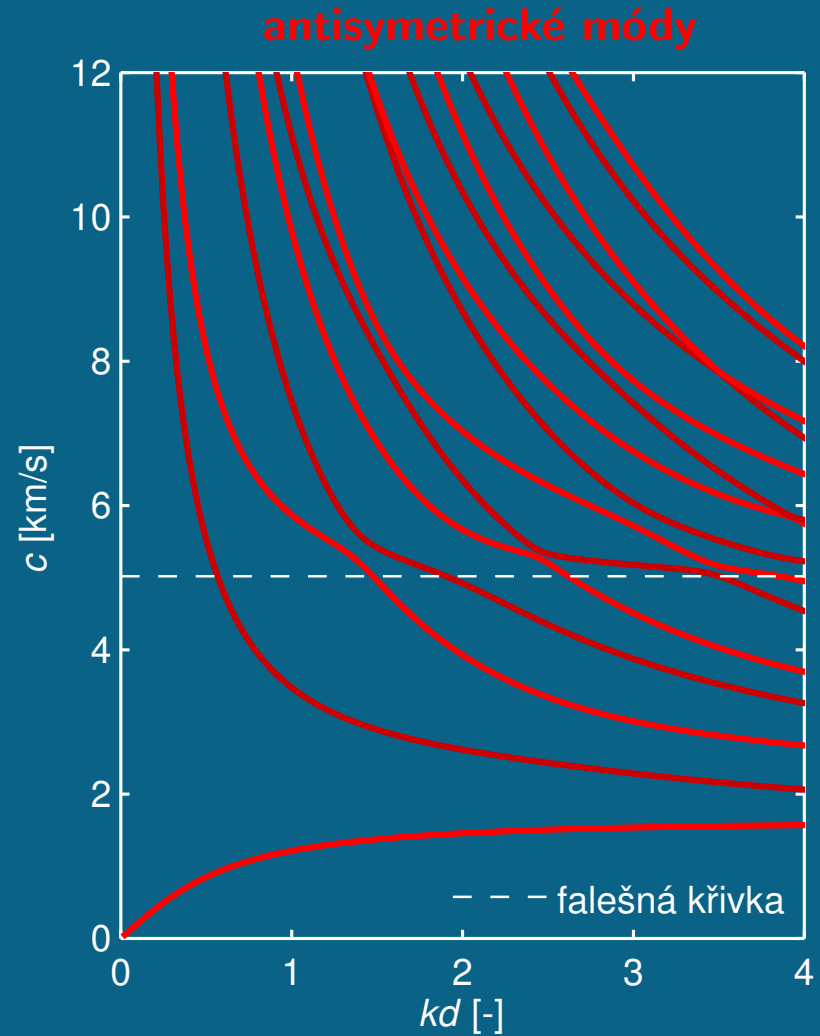
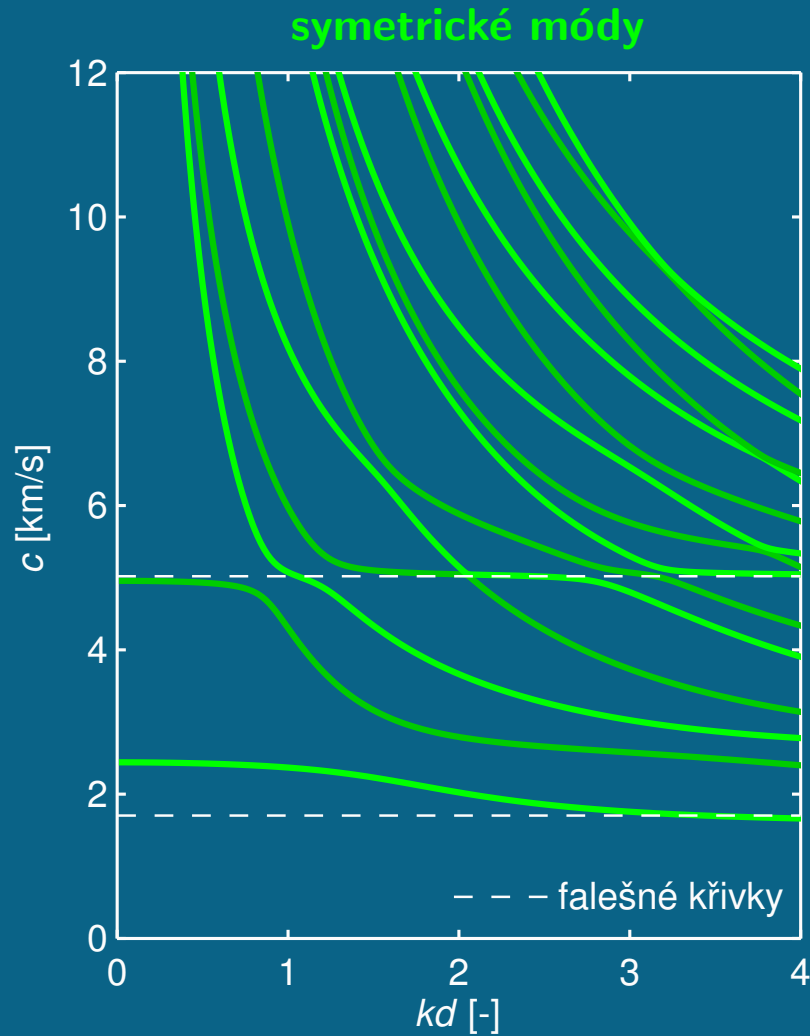
Směr šíření $\phi = 57^\circ$



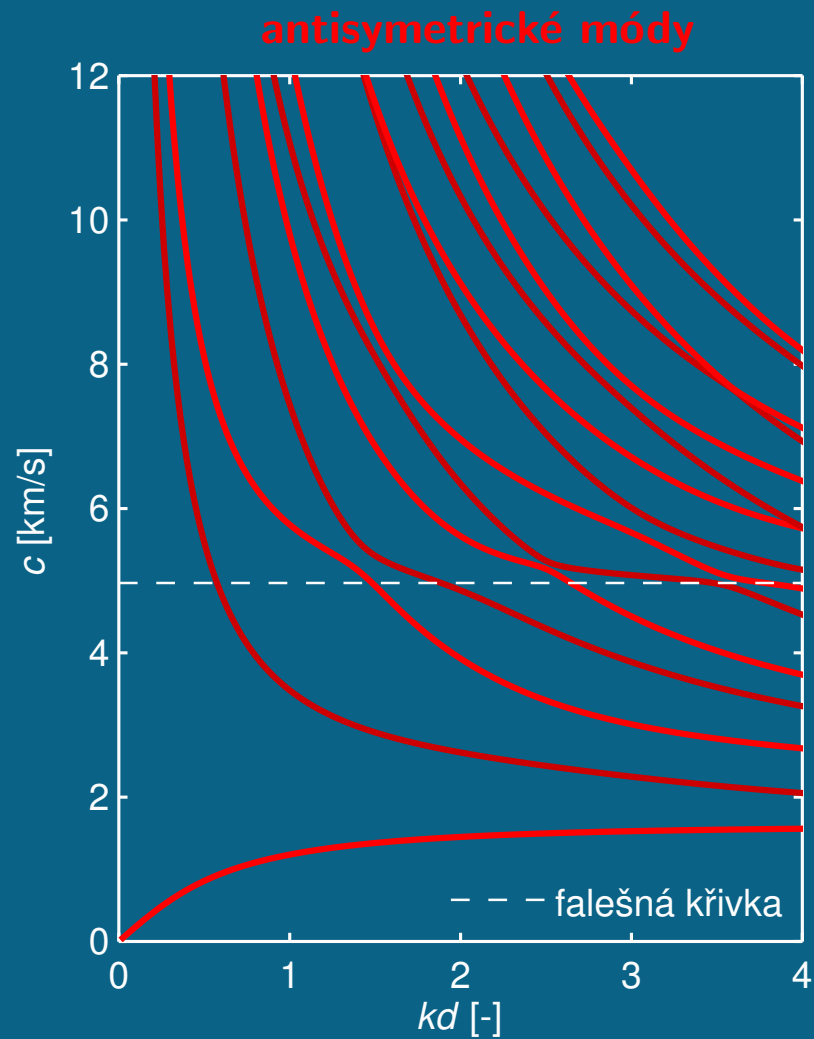
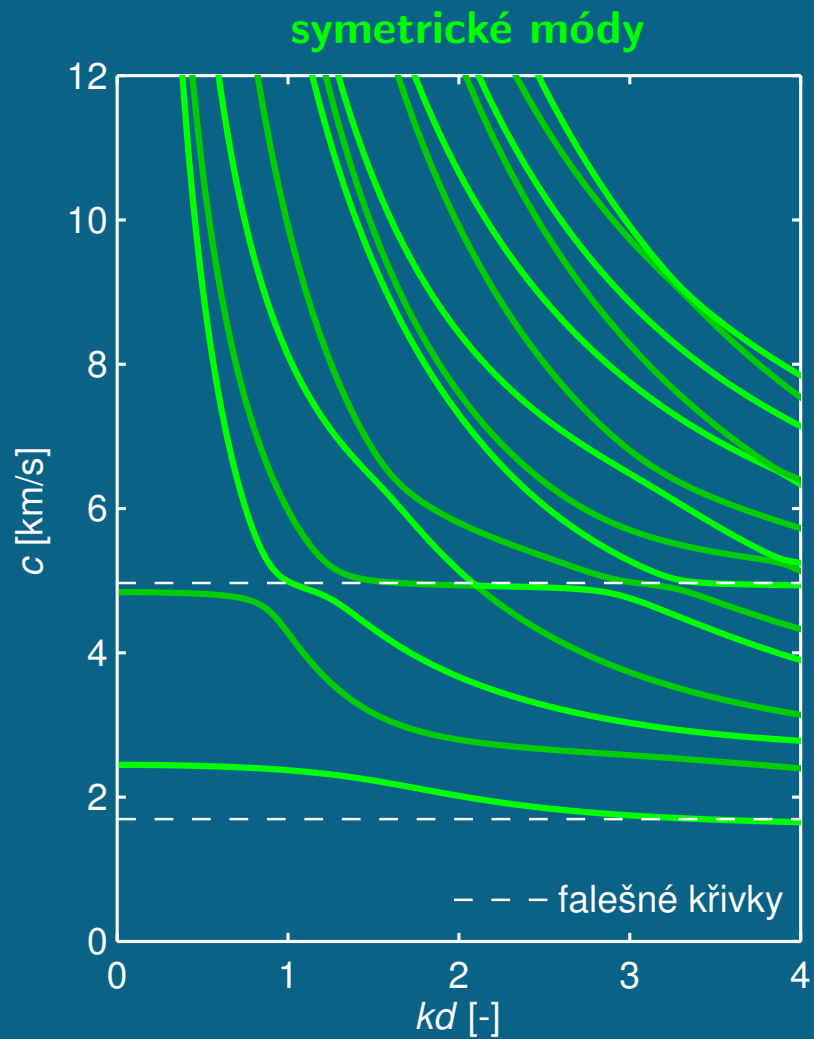
Směr šíření $\phi = 58^\circ$



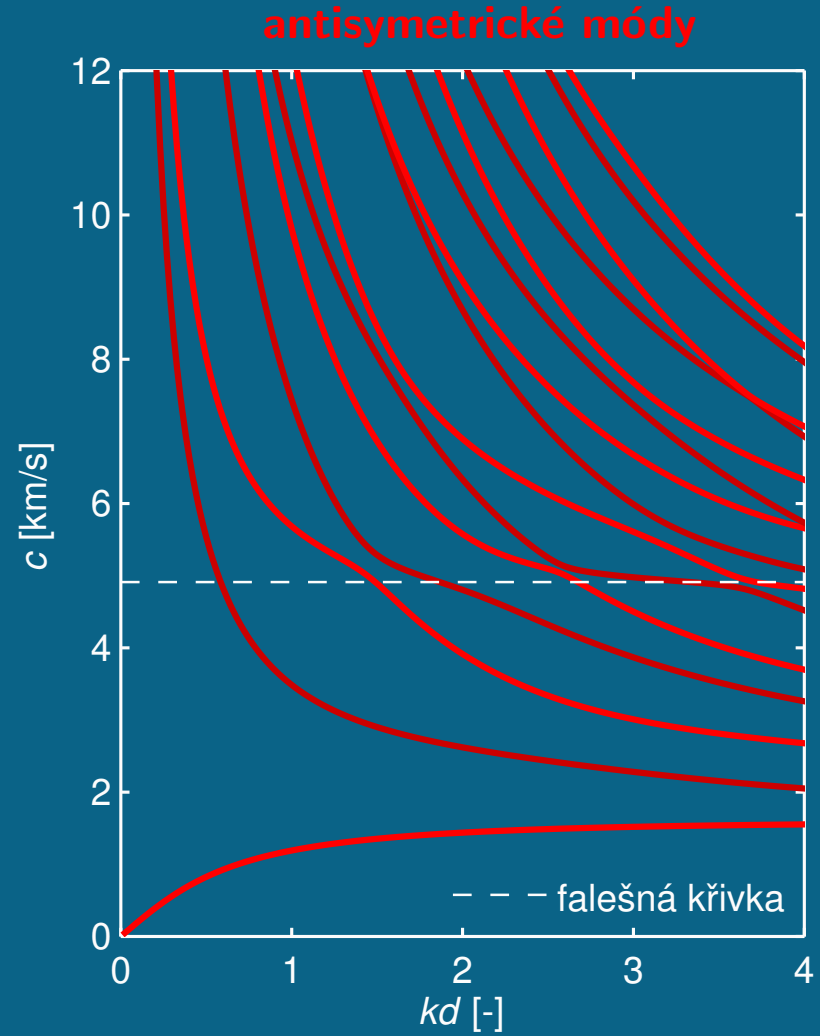
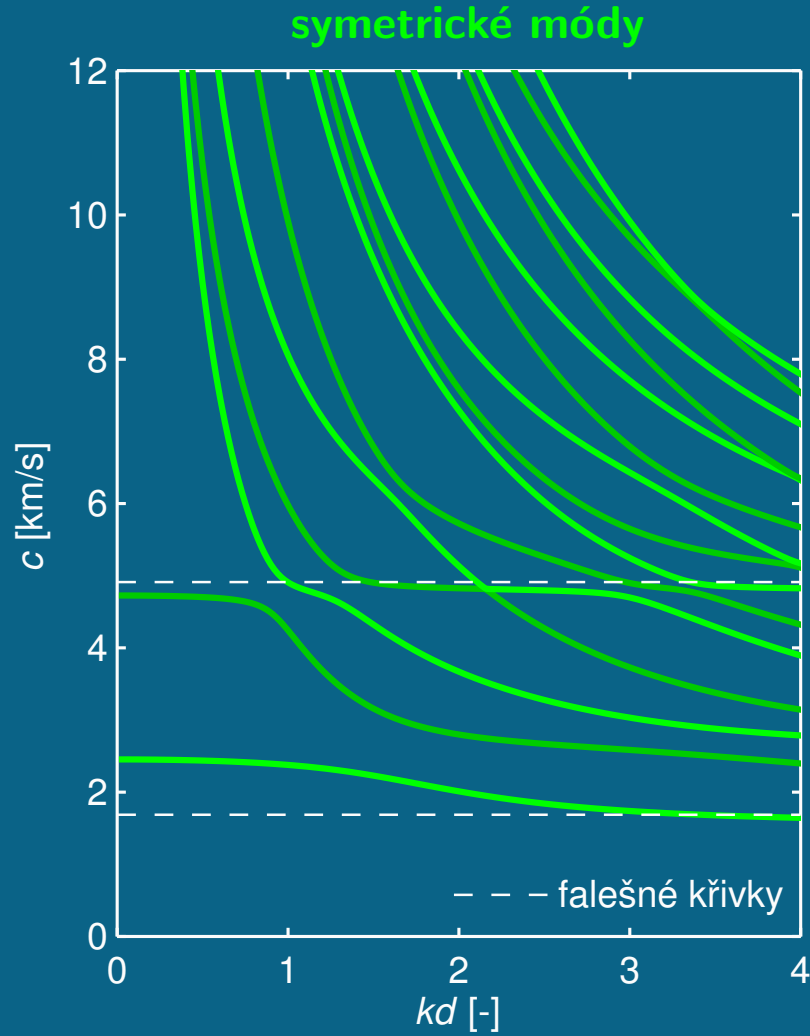
Směr šíření $\phi = 59^\circ$



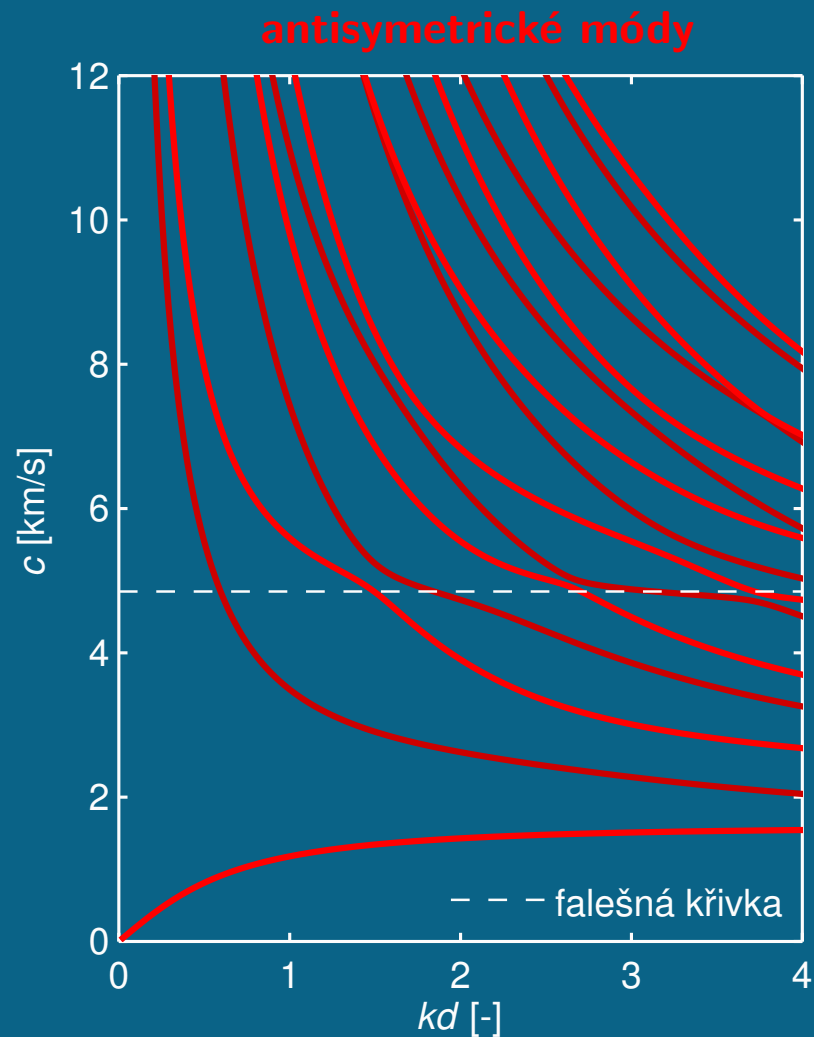
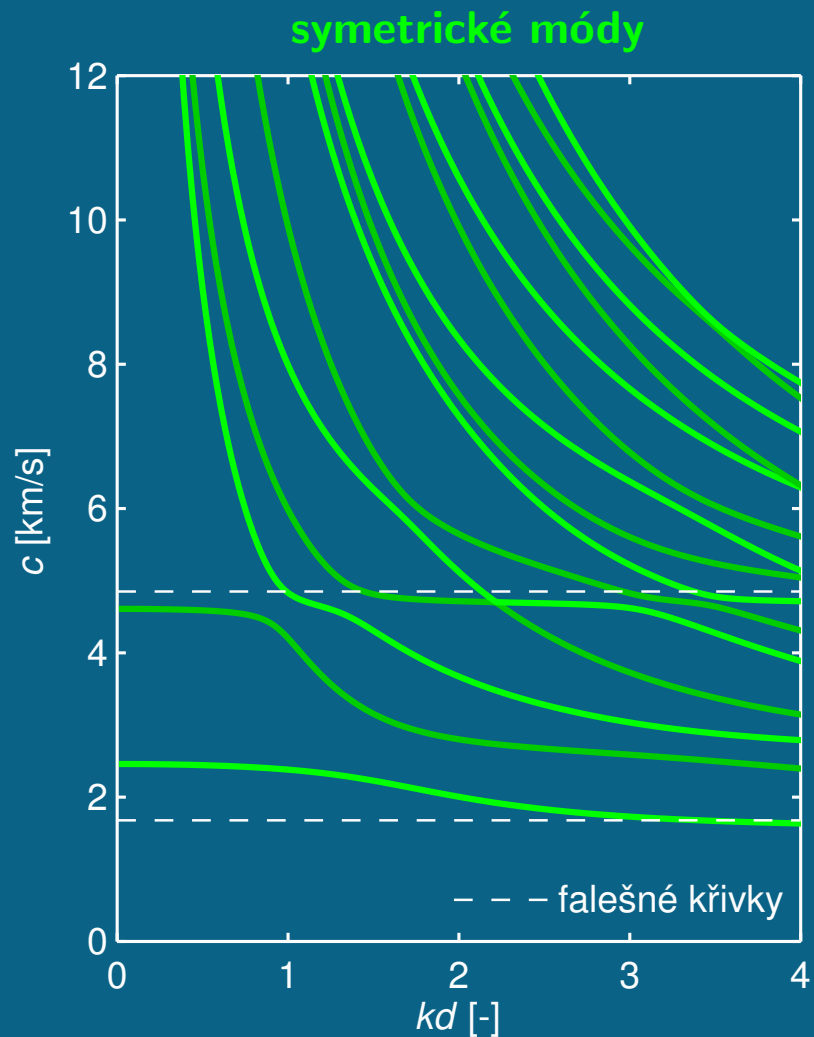
Směr šíření $\phi = 60^\circ$



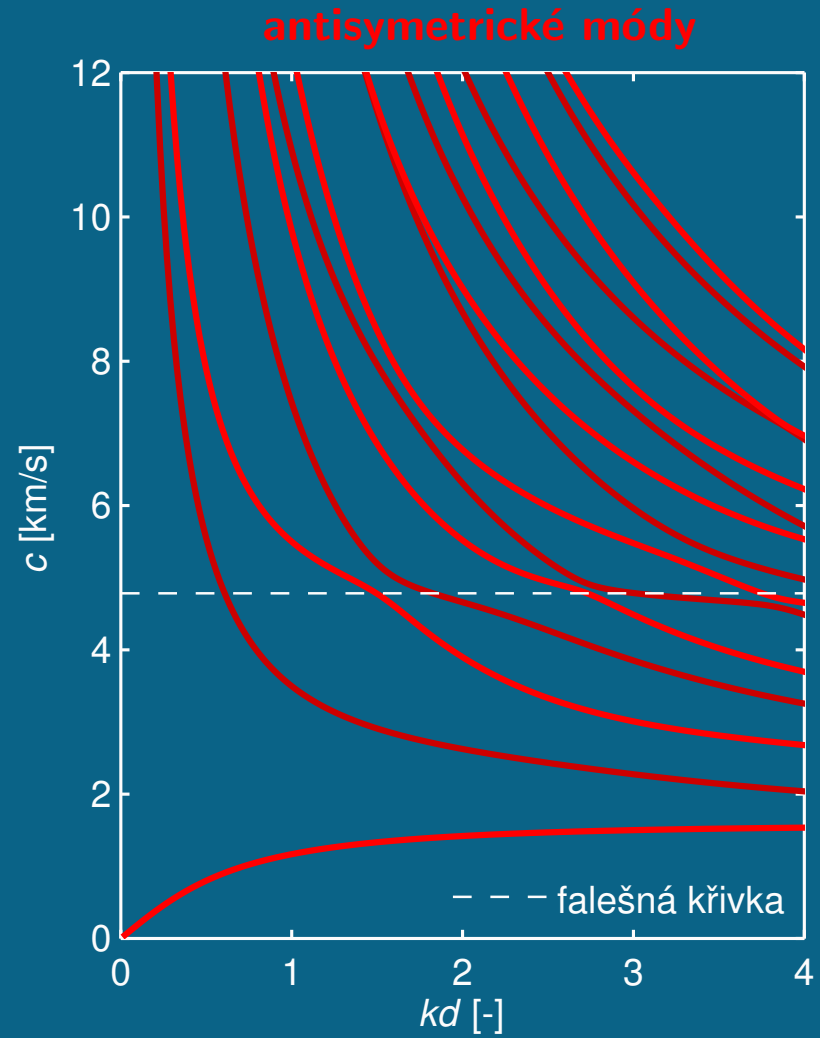
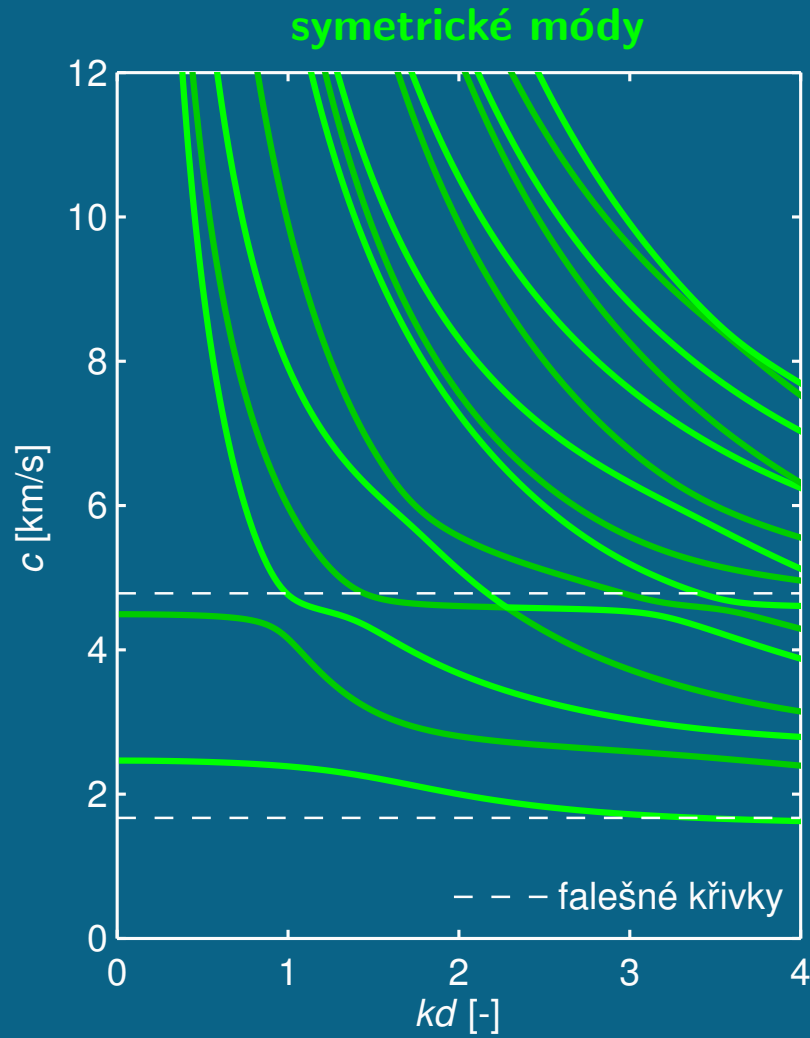
Směr šíření $\phi = 61^\circ$



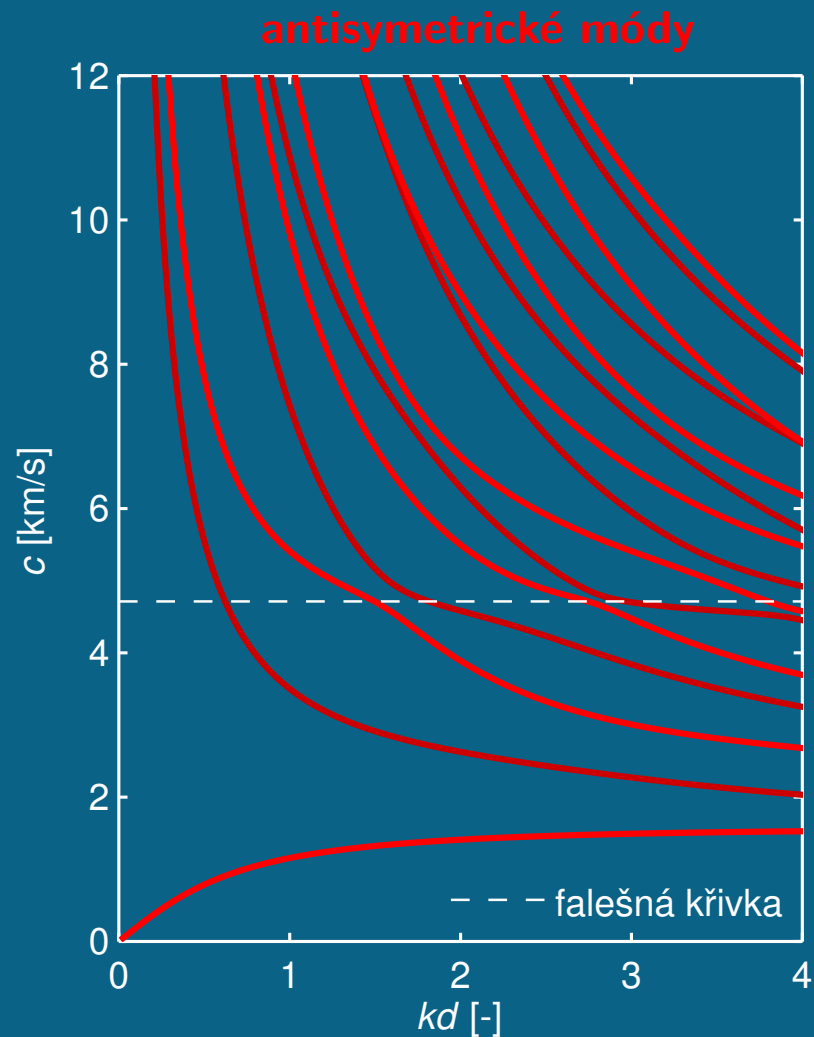
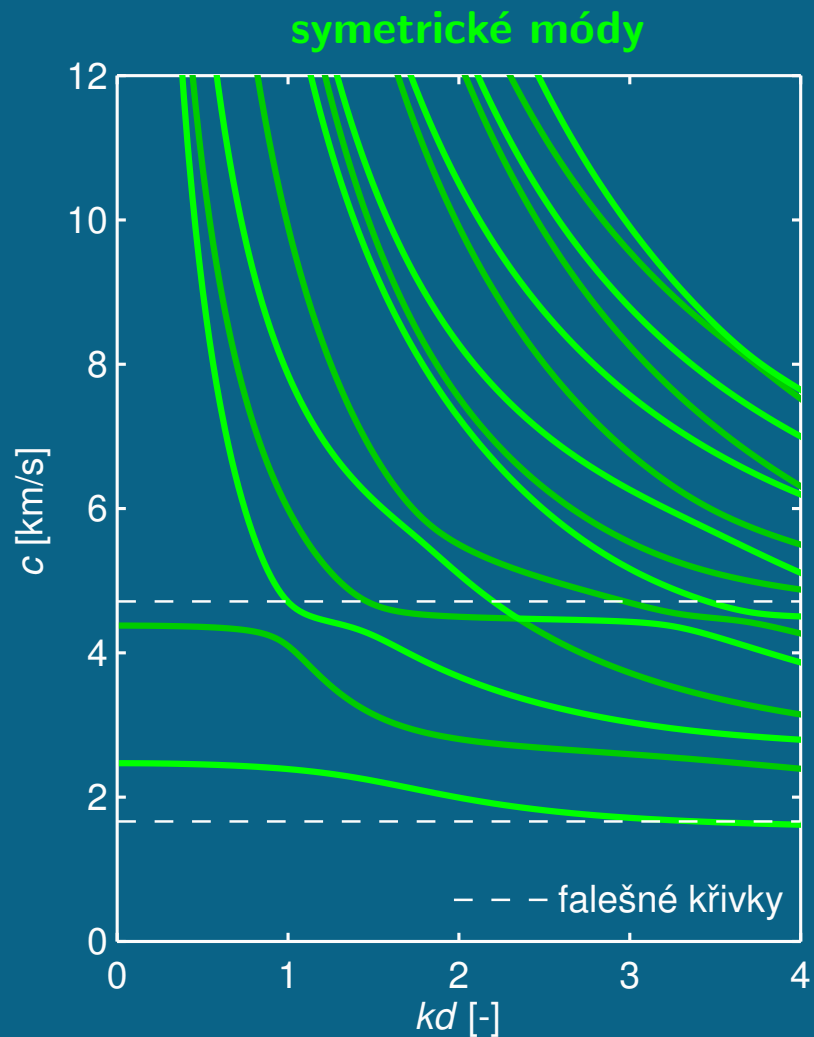
Směr šíření $\phi = 62^\circ$



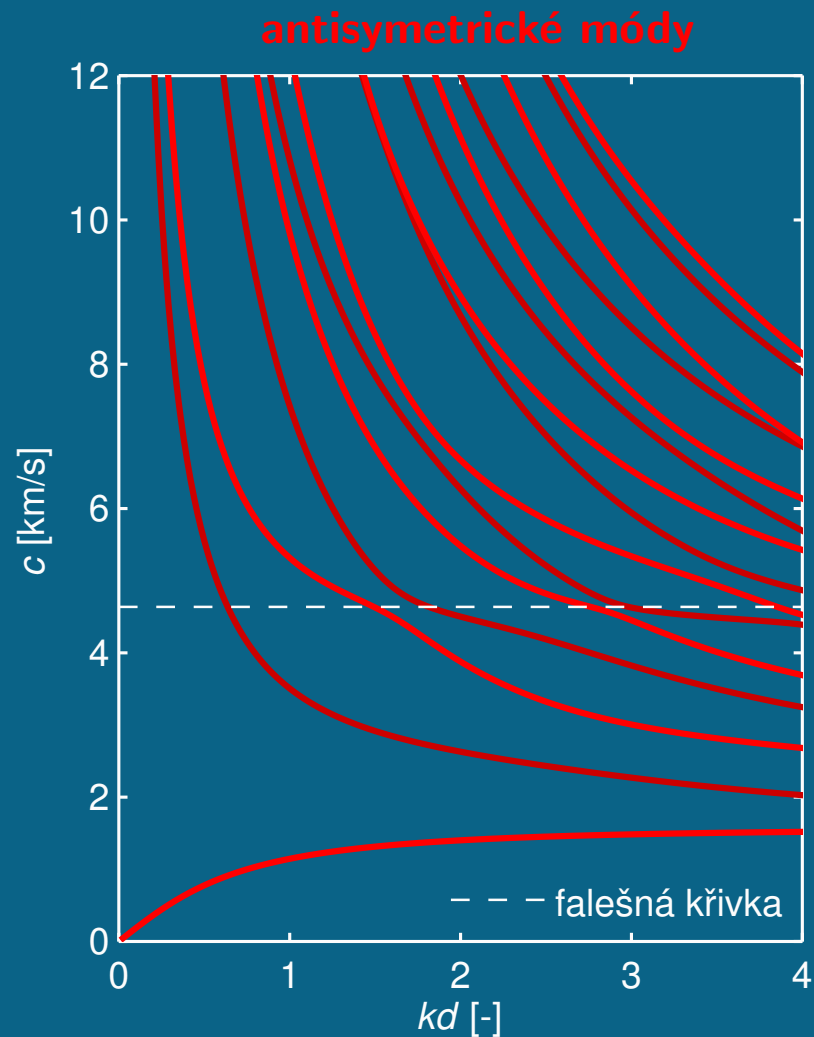
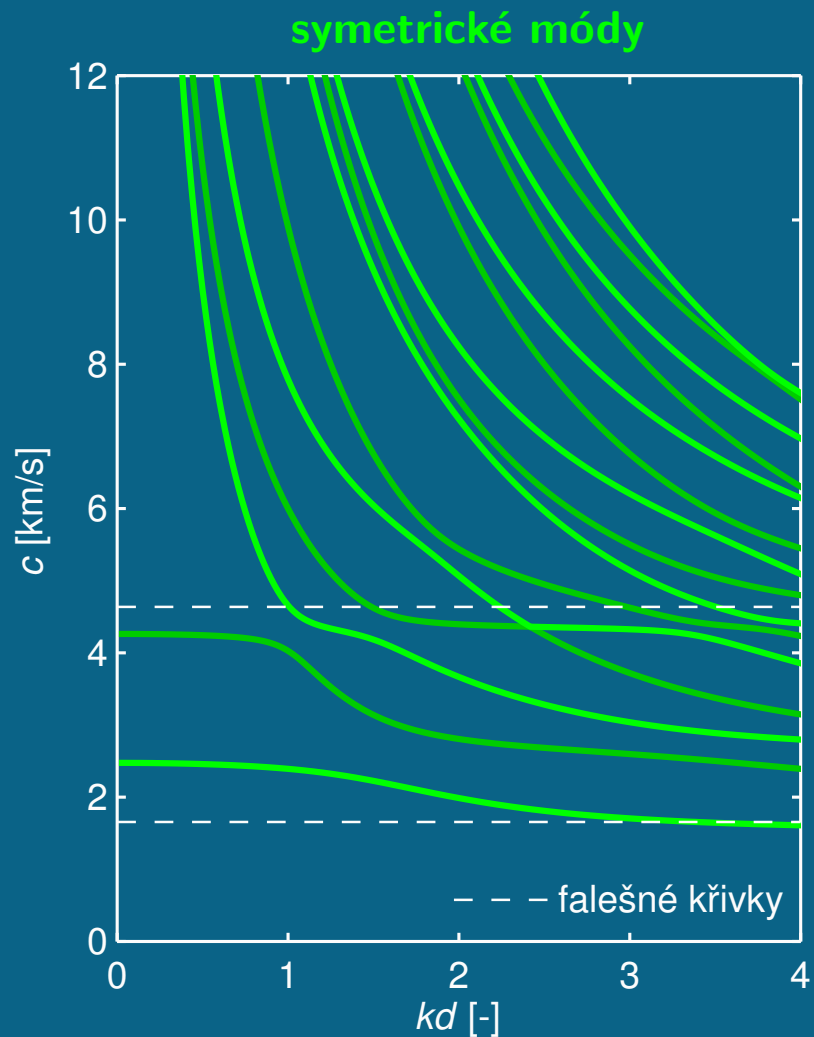
Směr šíření $\phi = 63^\circ$



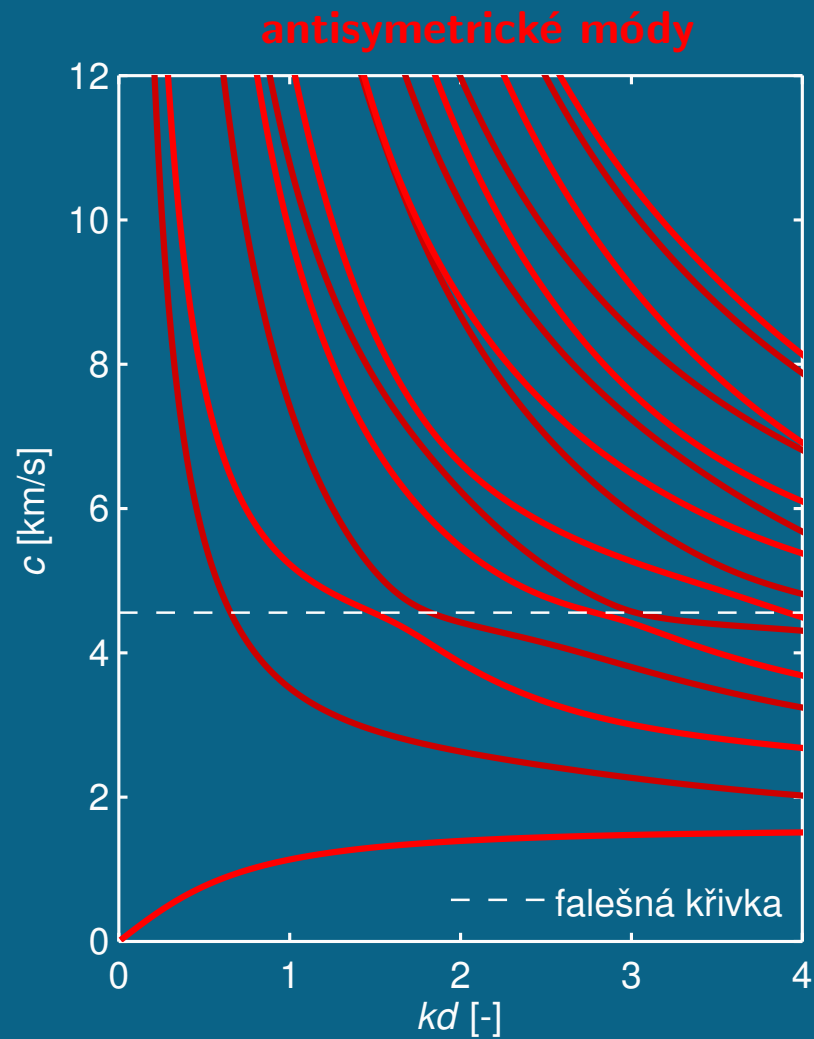
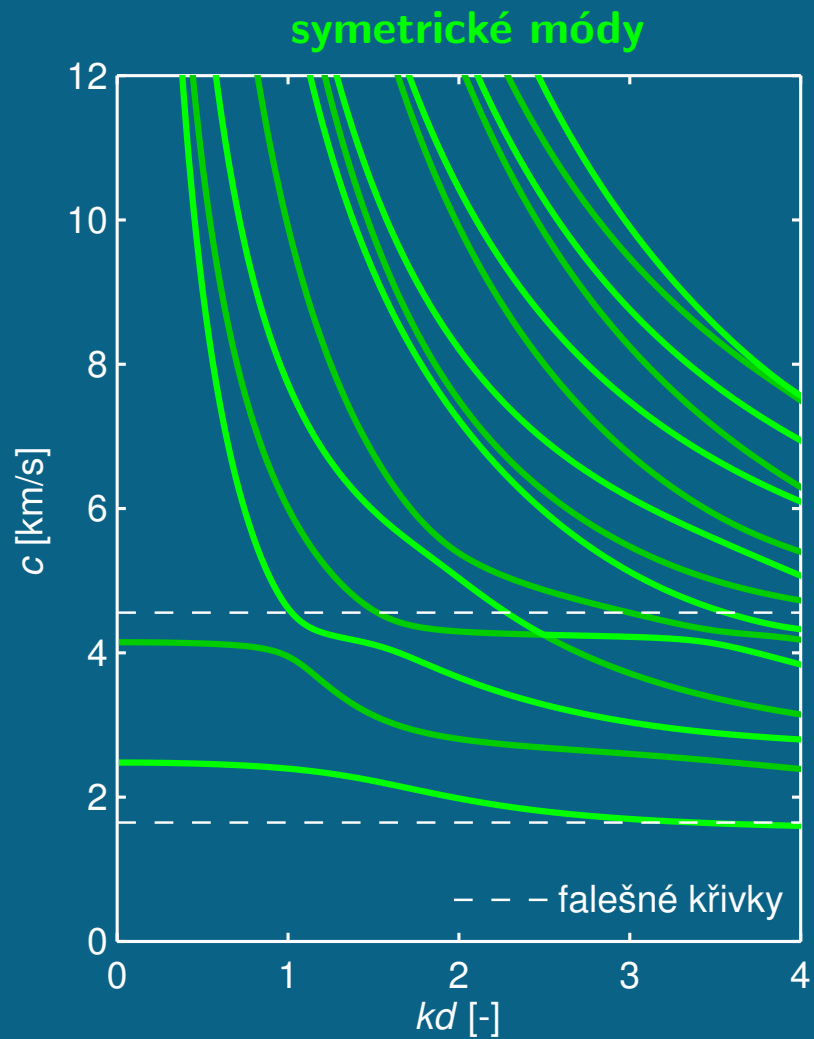
Směr šíření $\phi = 64^\circ$



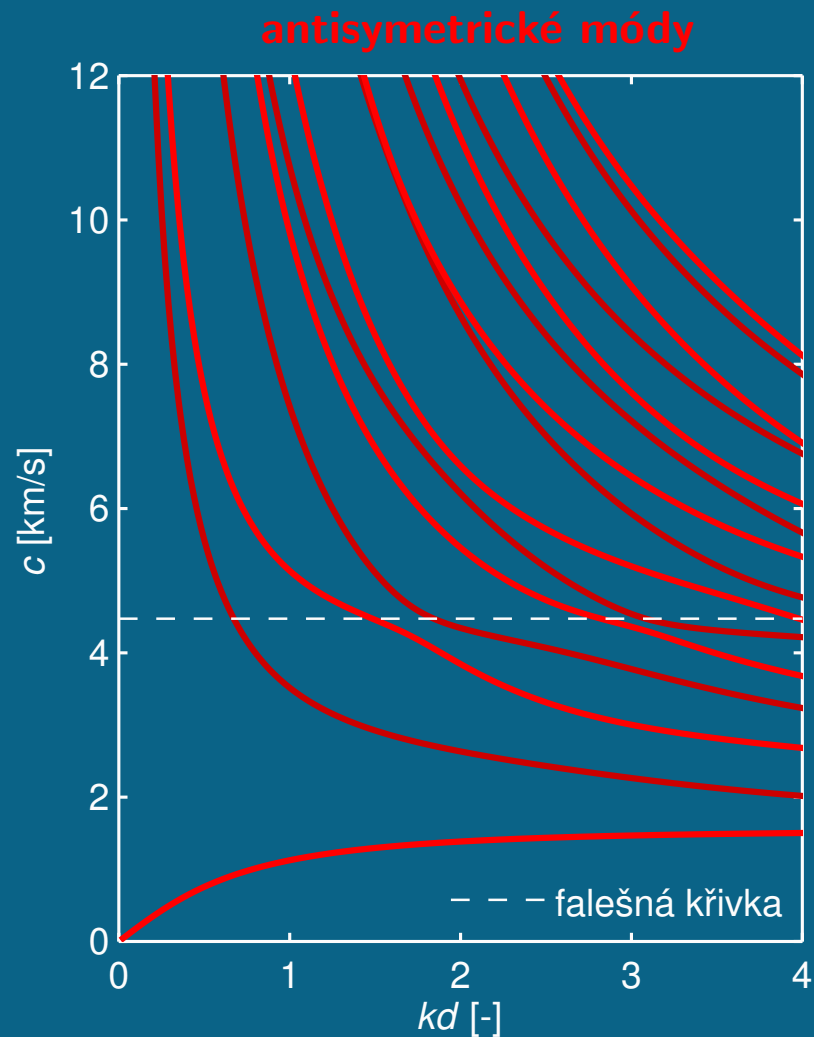
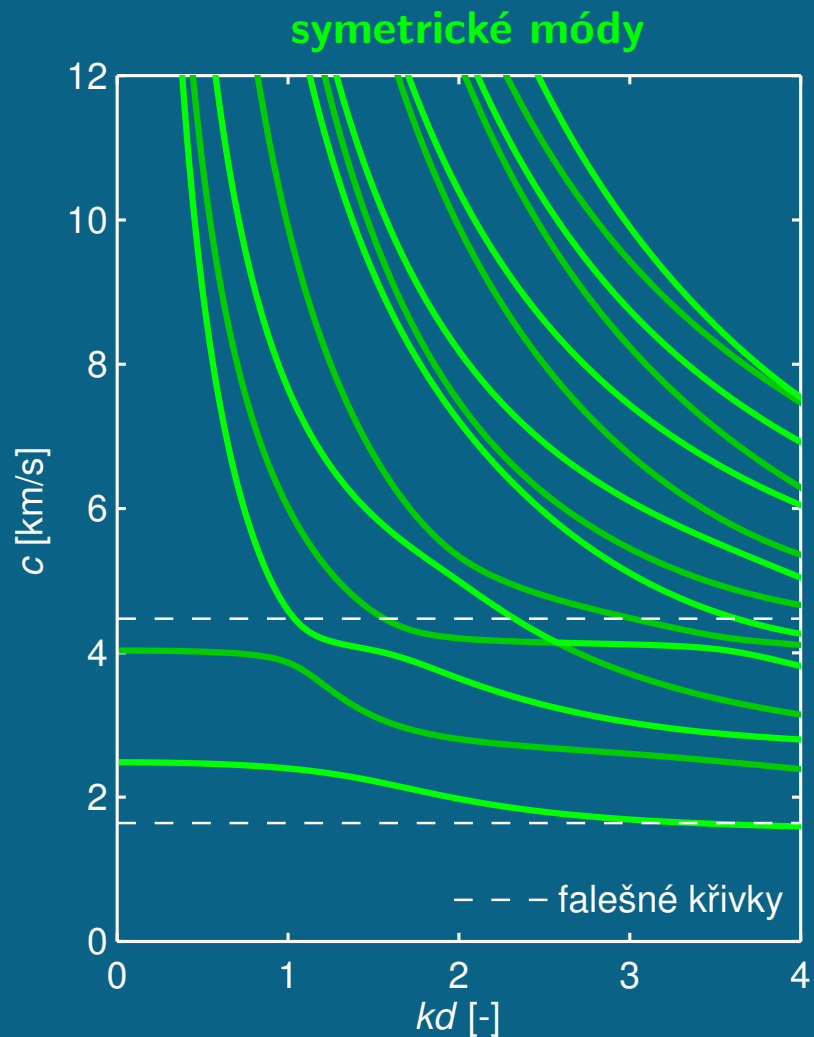
Směr šíření $\phi = 65^\circ$



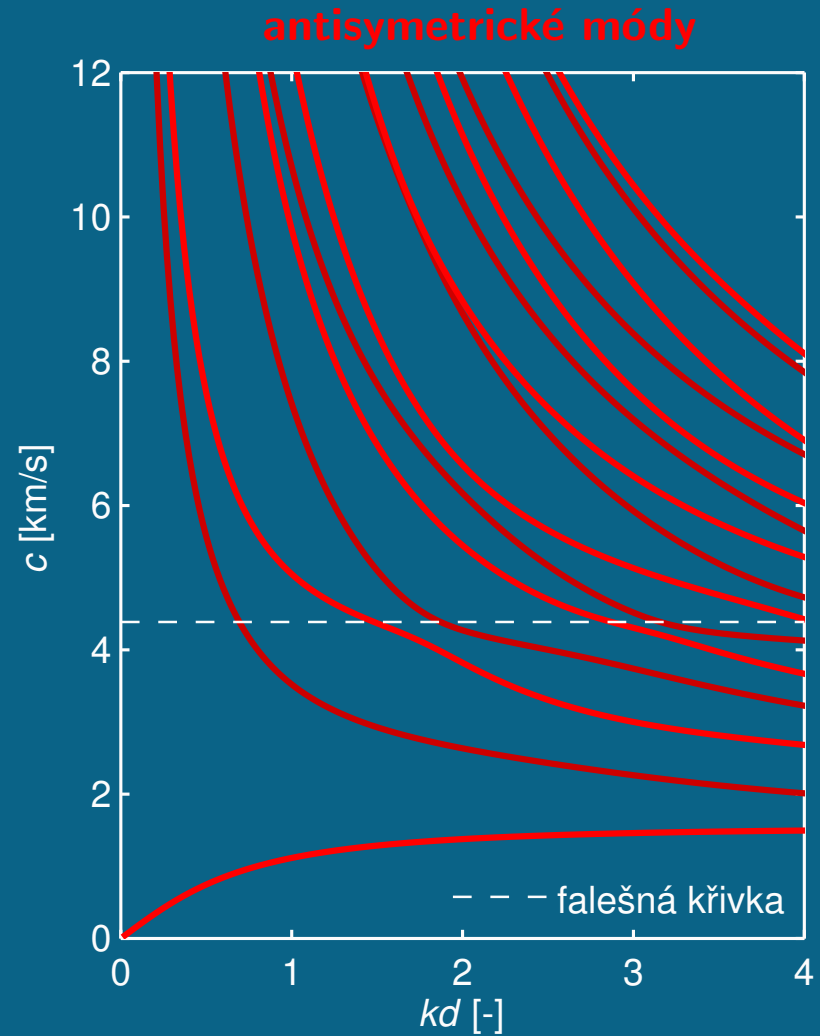
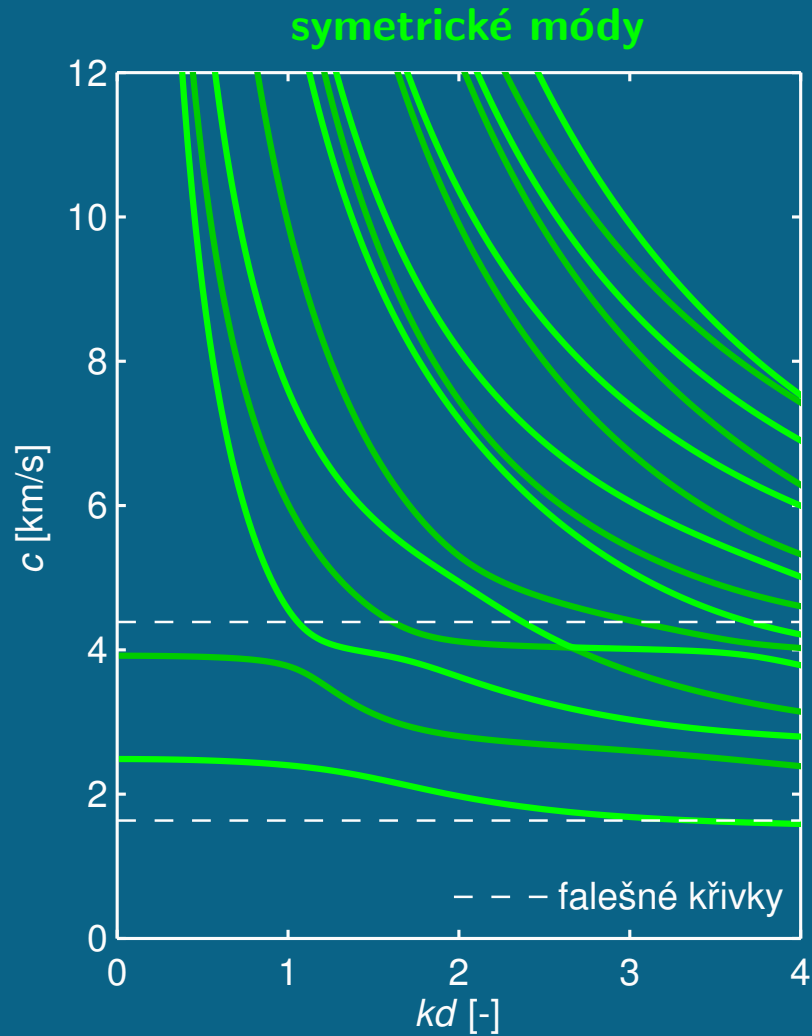
Směr šíření $\phi = 66^\circ$



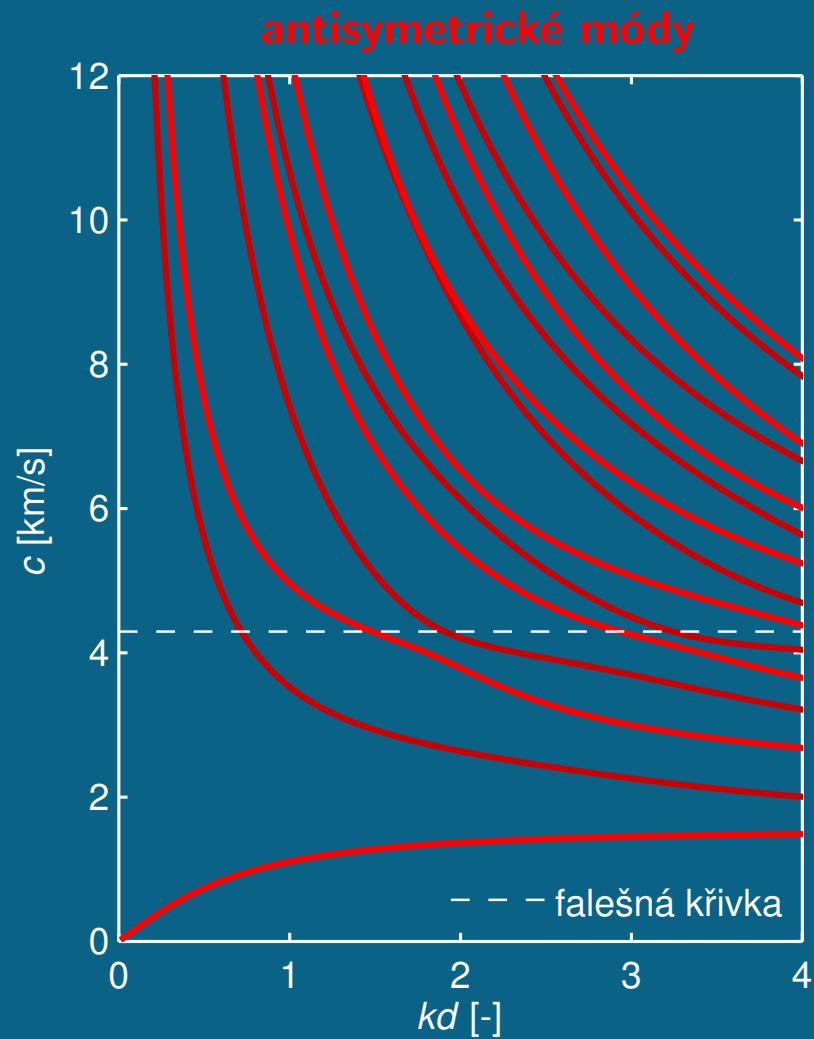
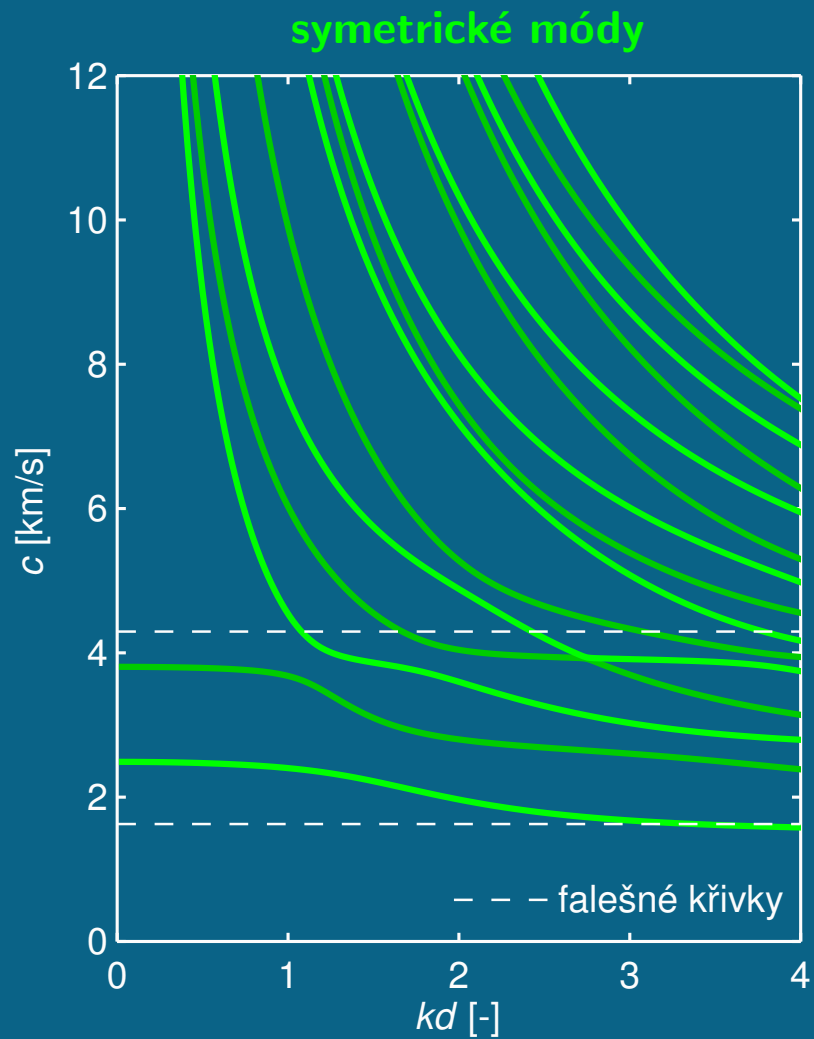
Směr šíření $\phi = 67^\circ$



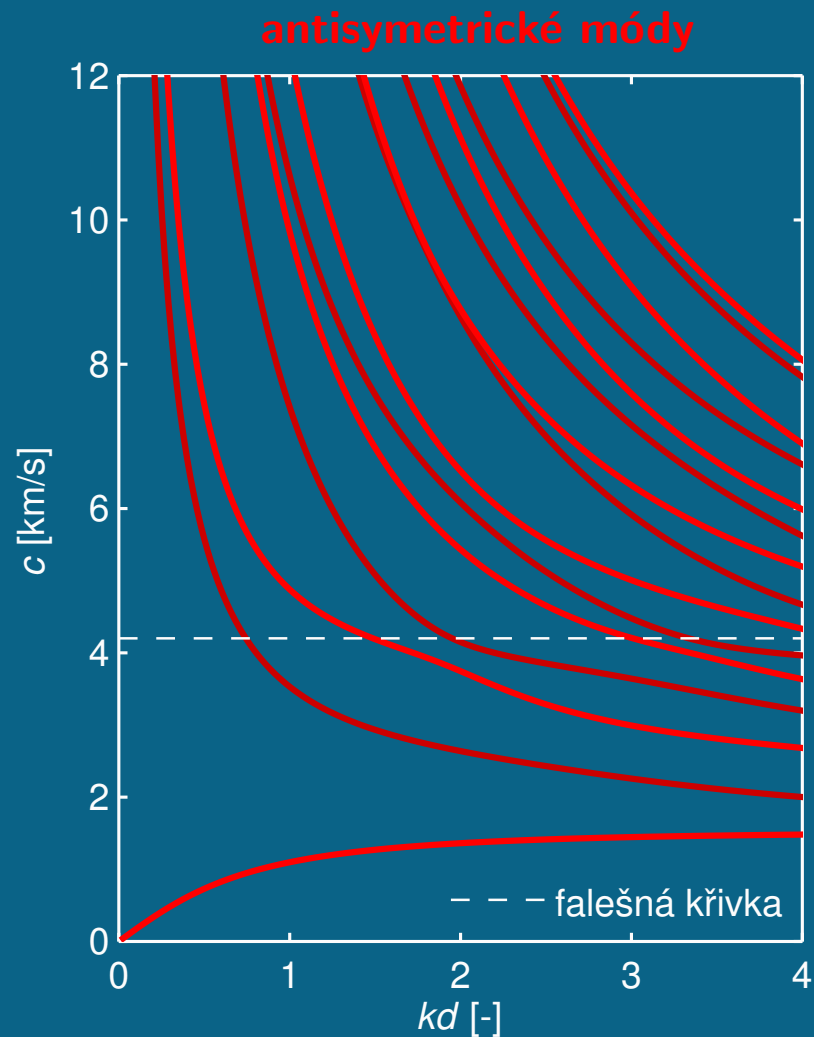
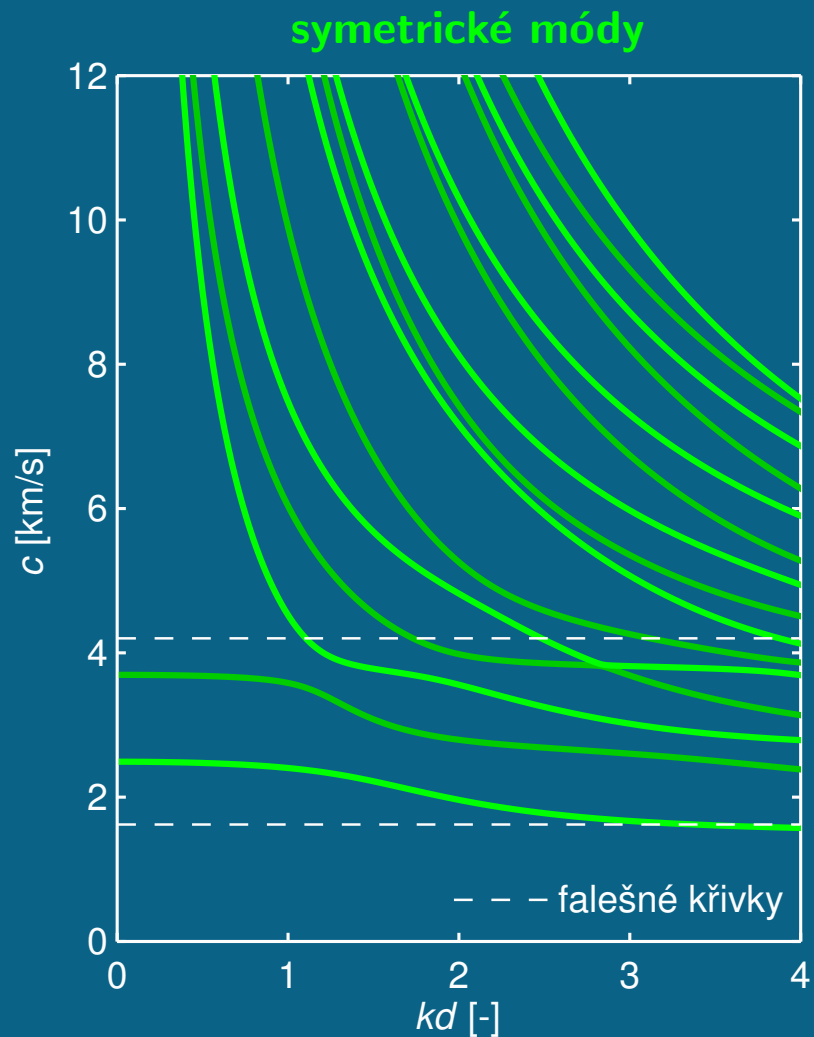
Směr šíření $\phi = 68^\circ$



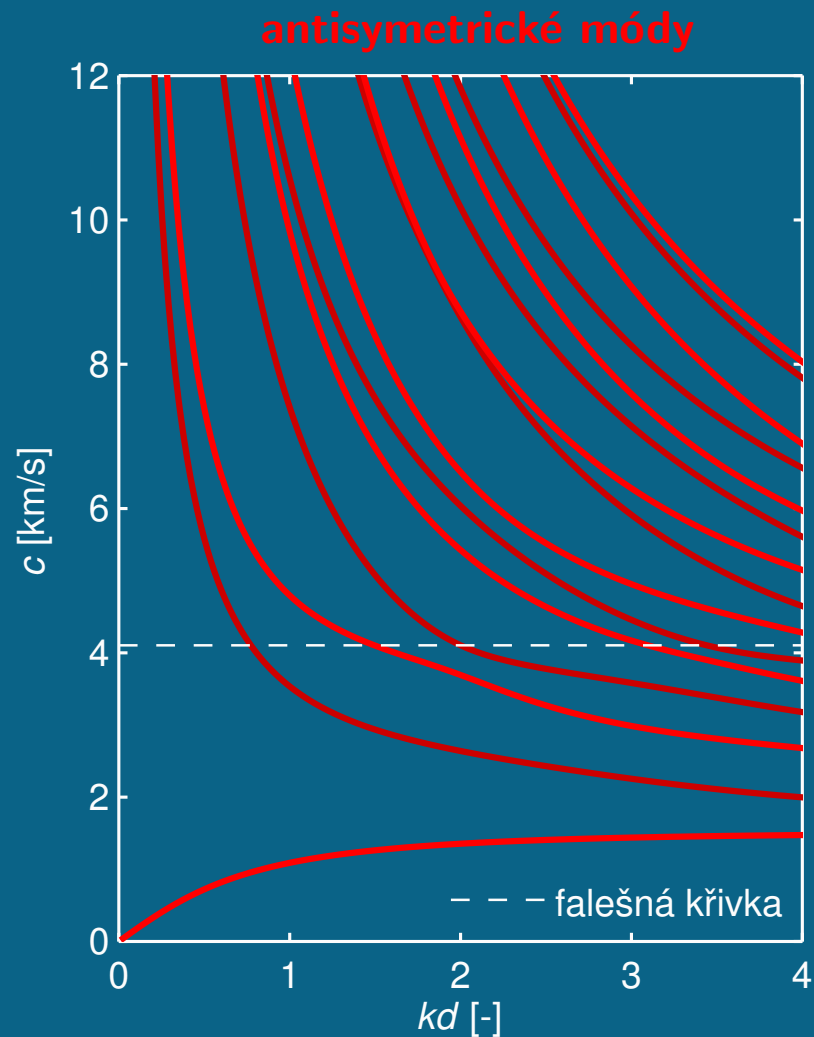
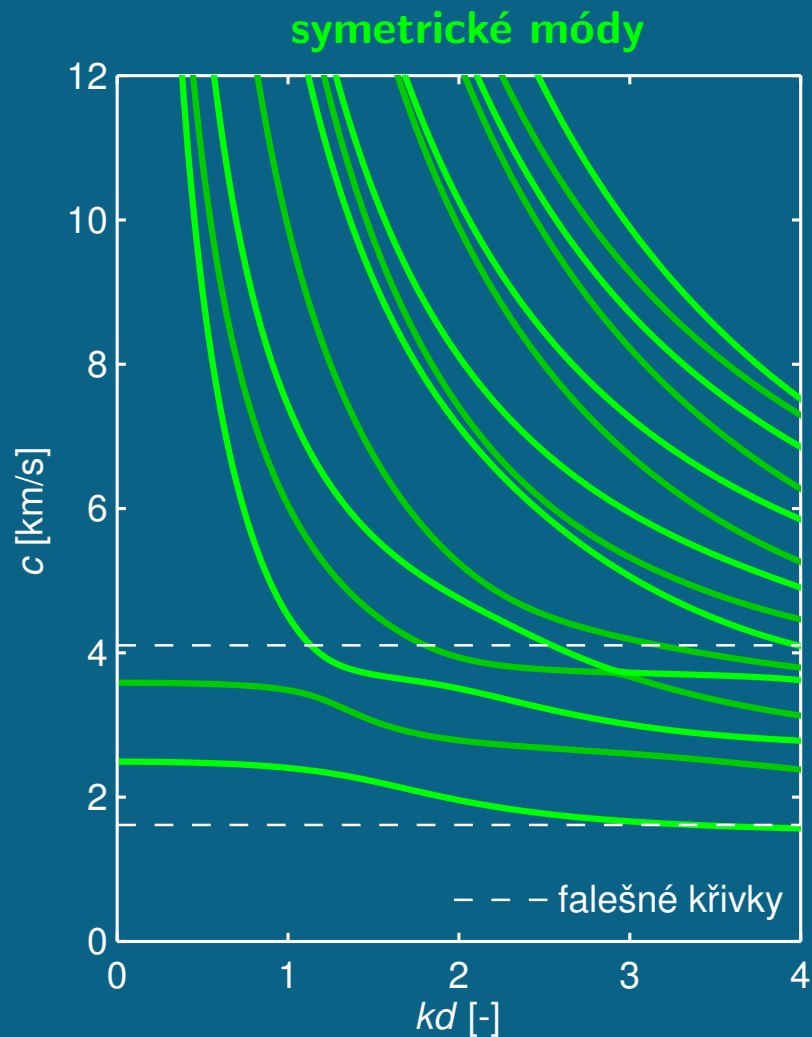
Směr šíření $\phi = 69^\circ$



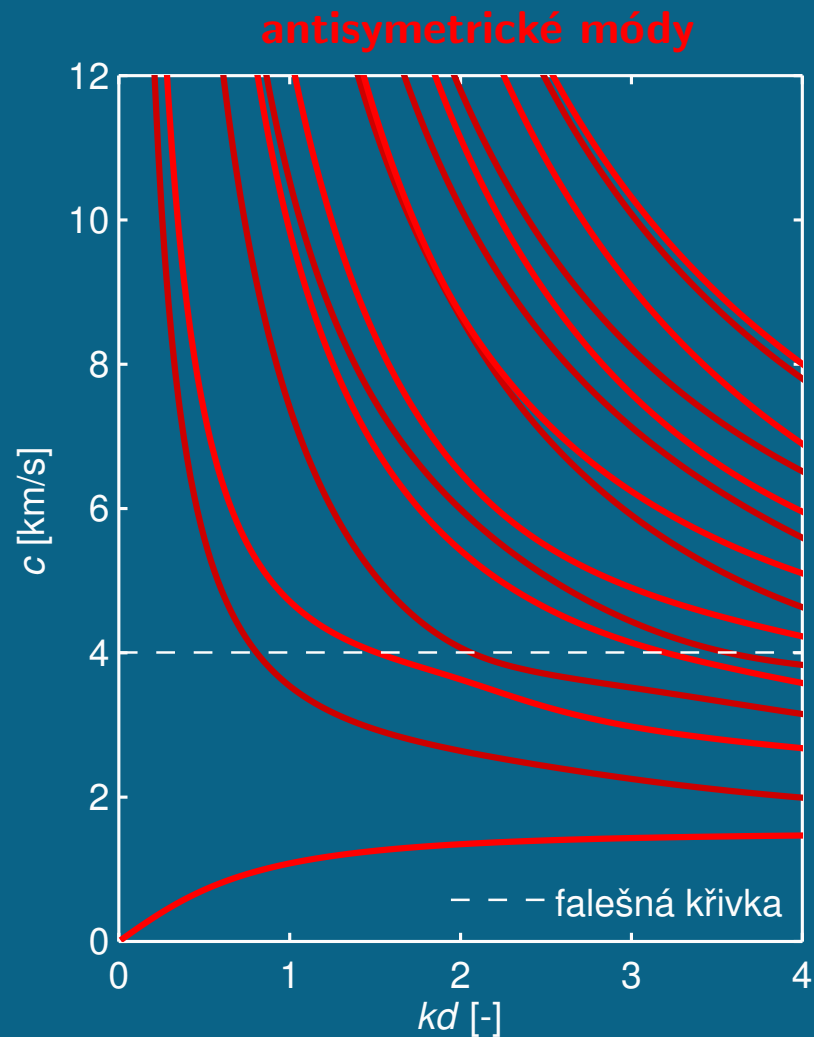
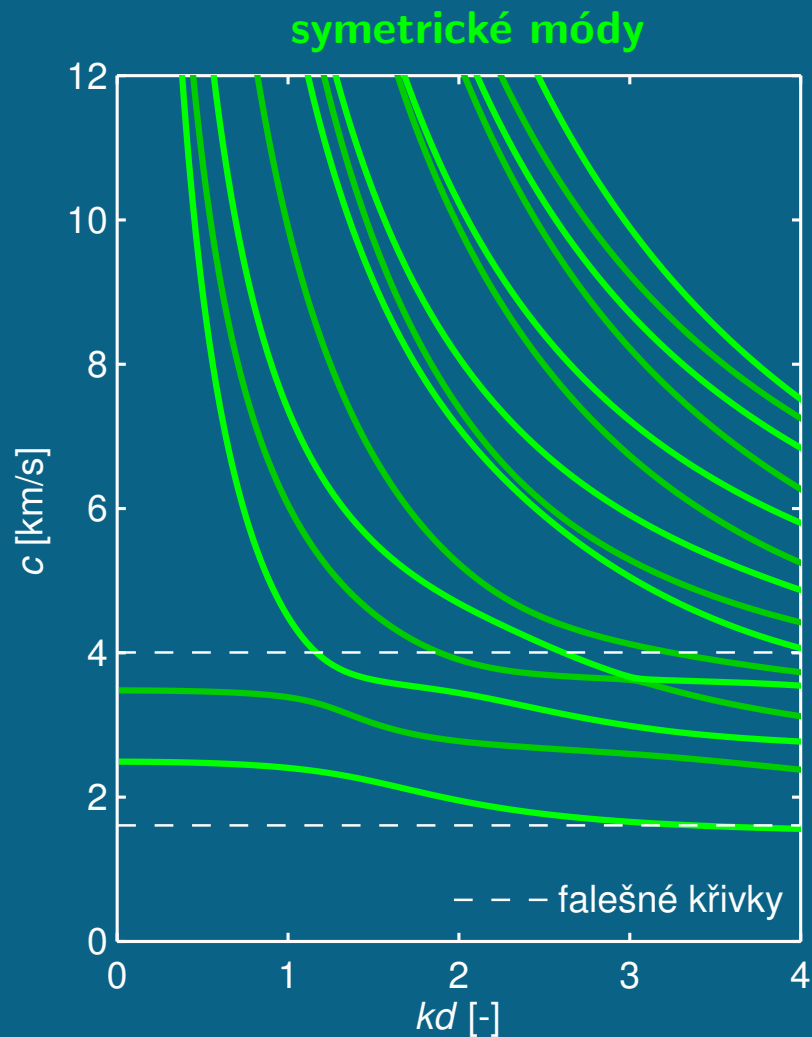
Směr šíření $\phi = 70^\circ$



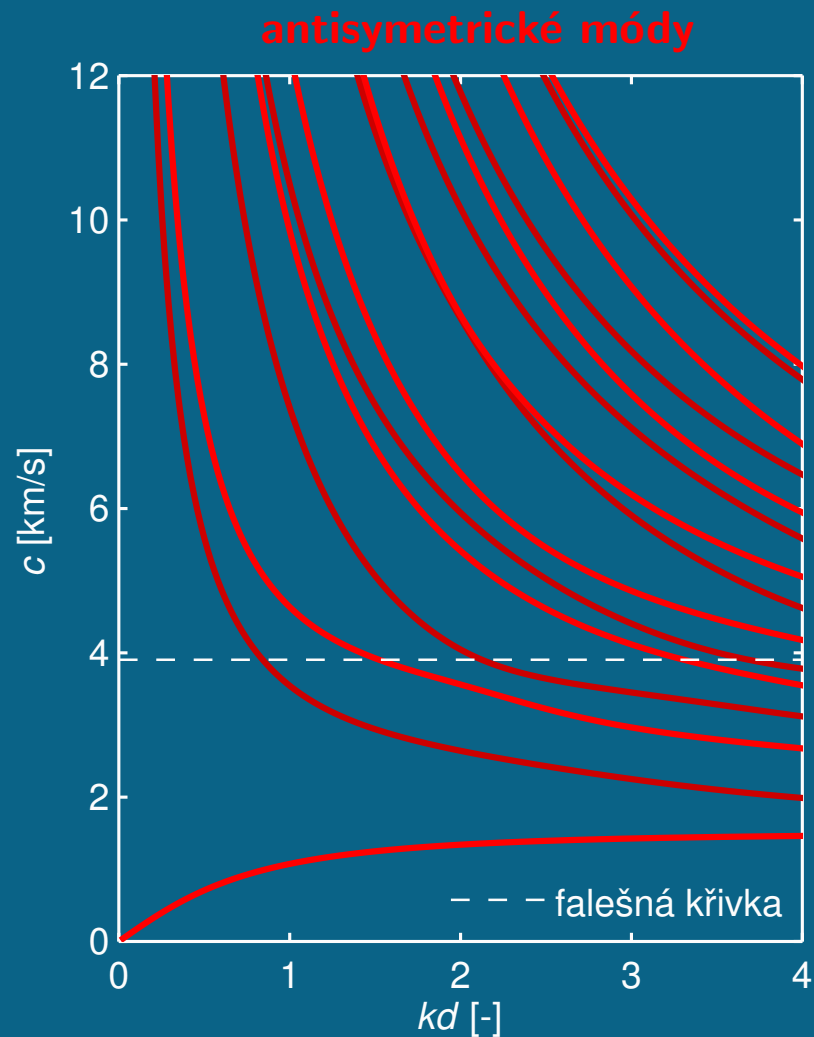
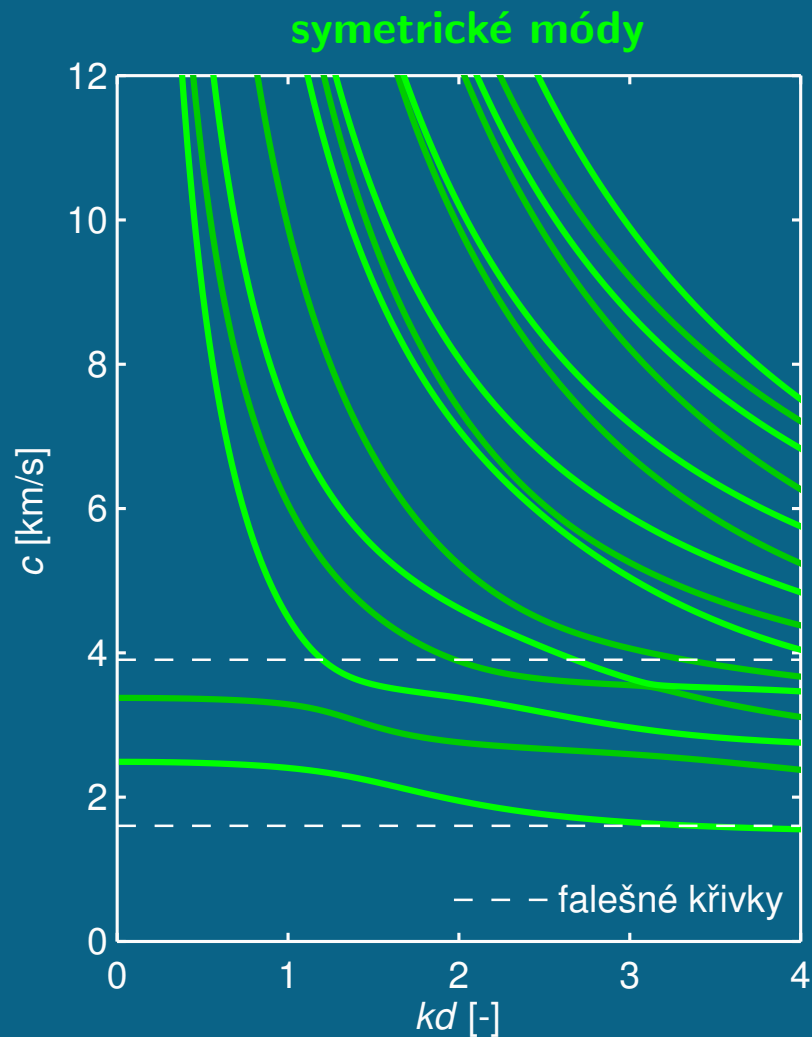
Směr šíření $\phi = 71^\circ$



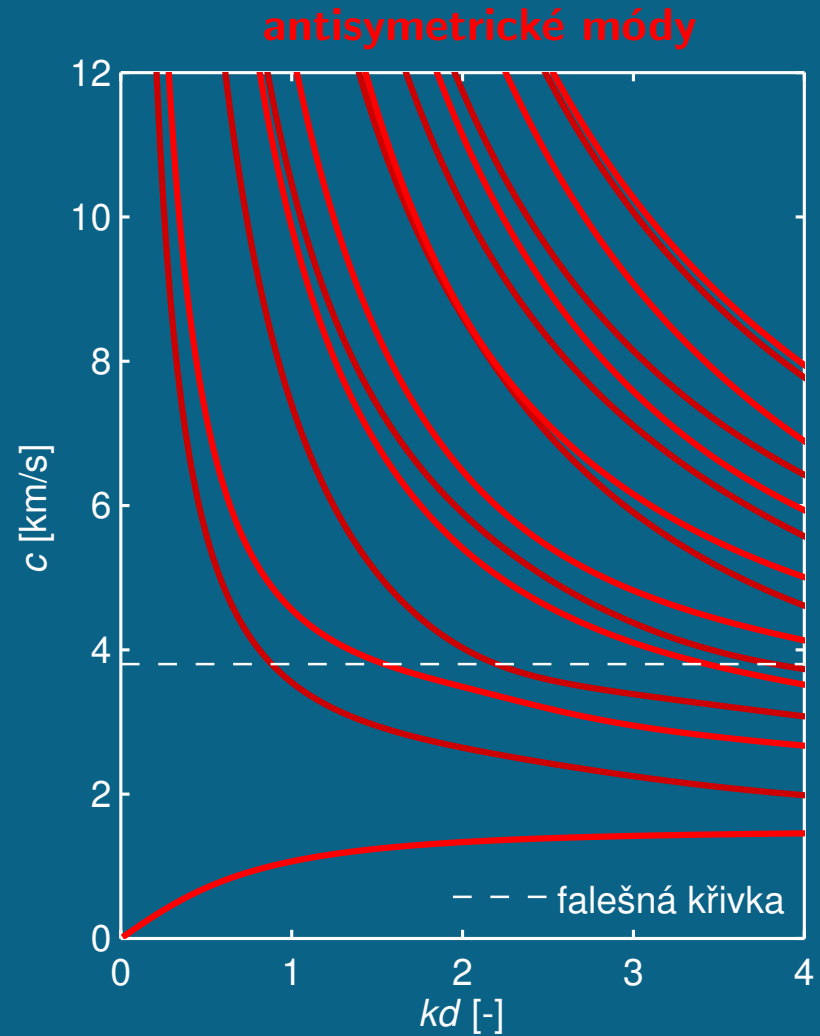
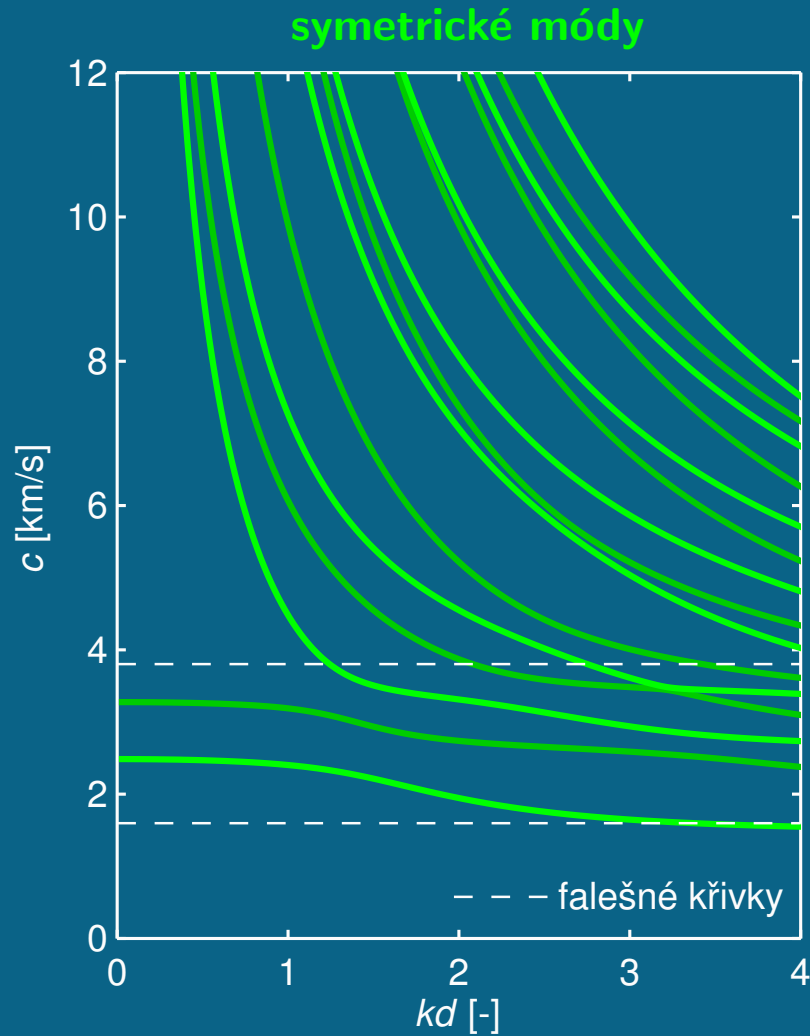
Směr šíření $\phi = 72^\circ$



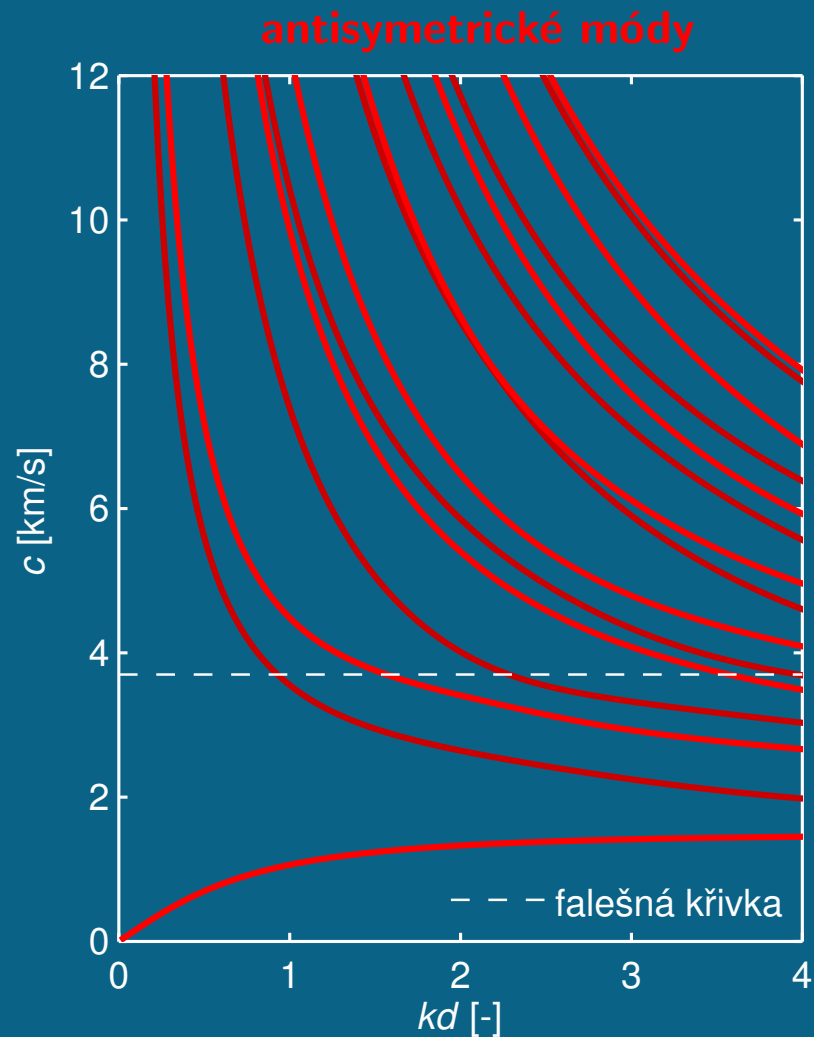
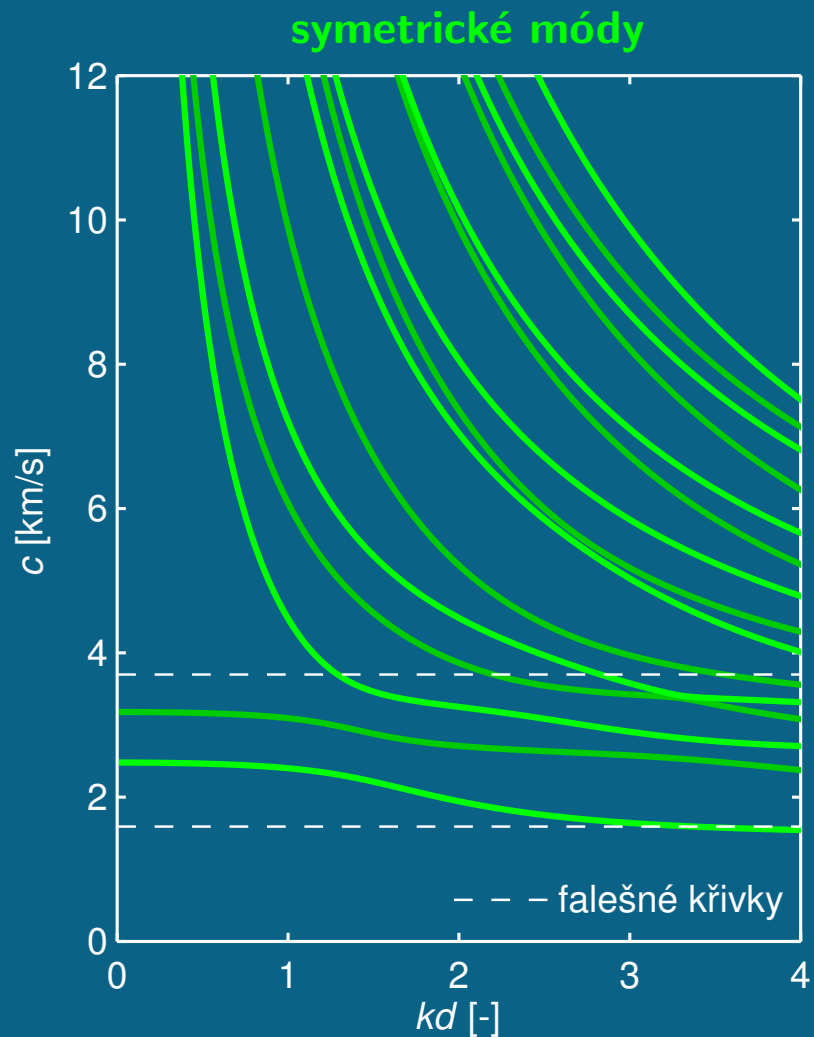
Směr šíření $\phi = 73^\circ$



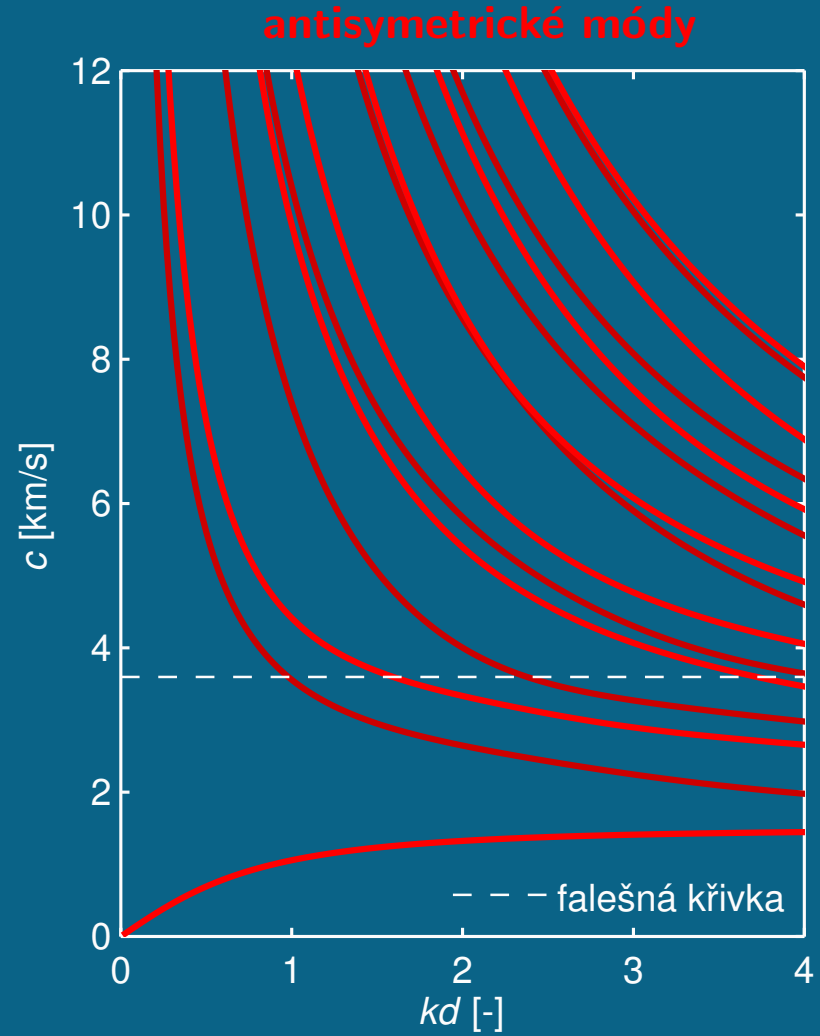
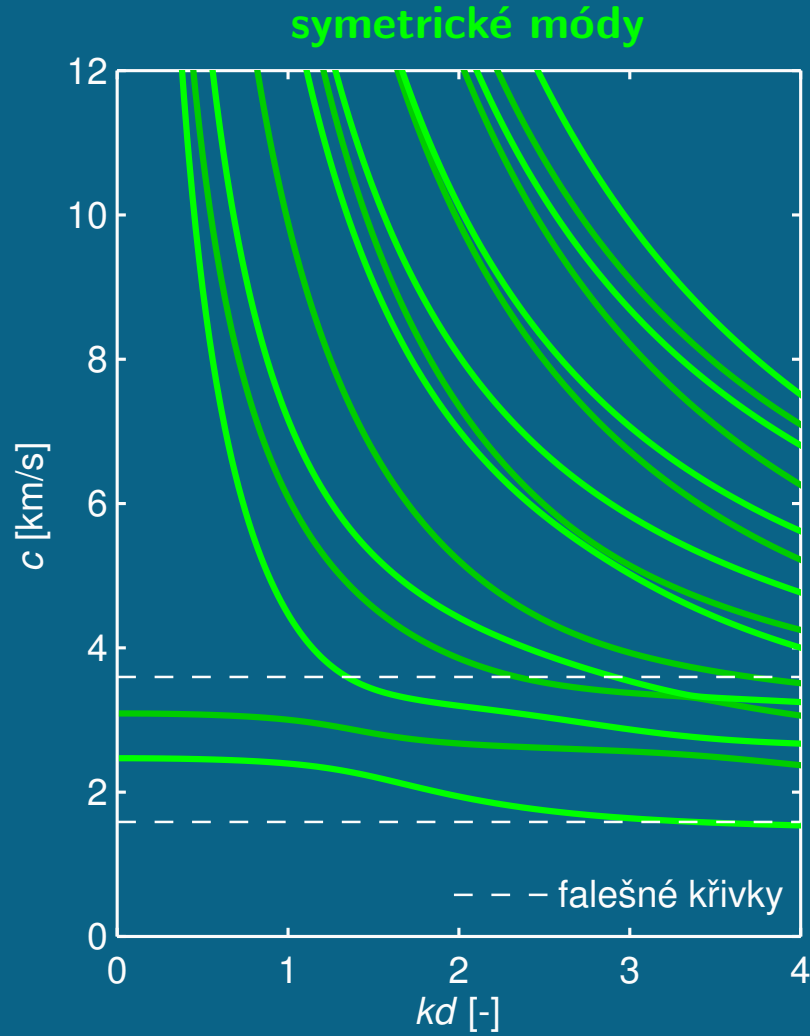
Směr šíření $\phi = 74^\circ$



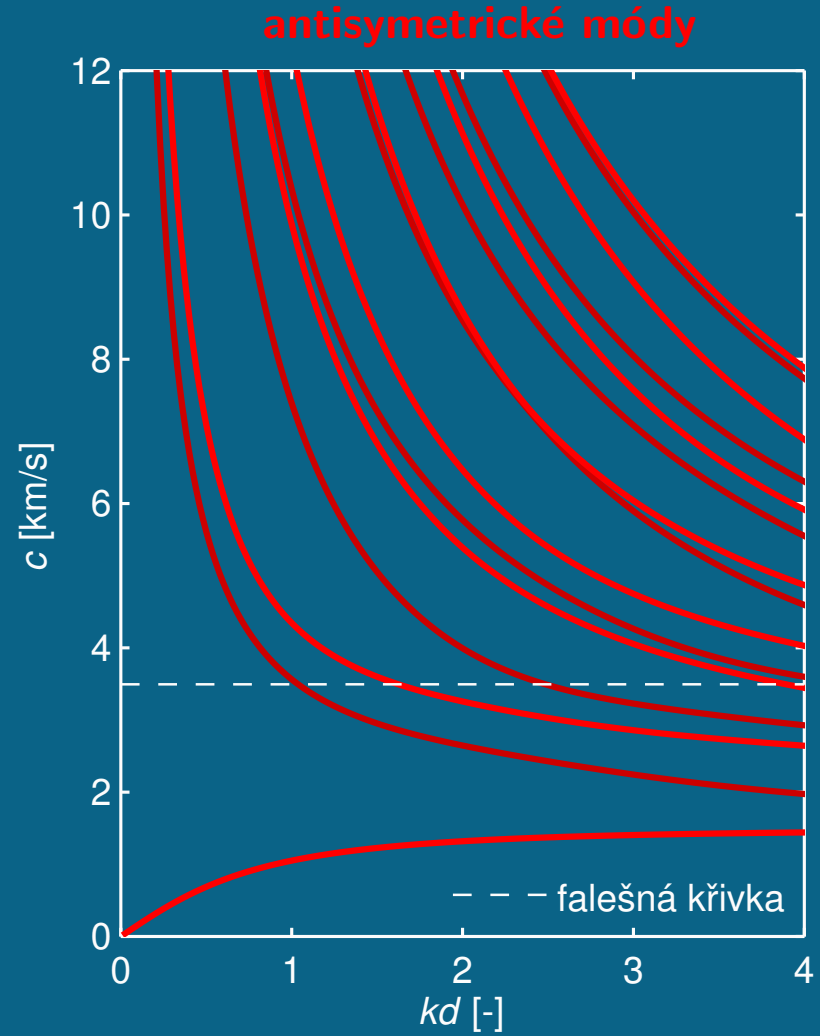
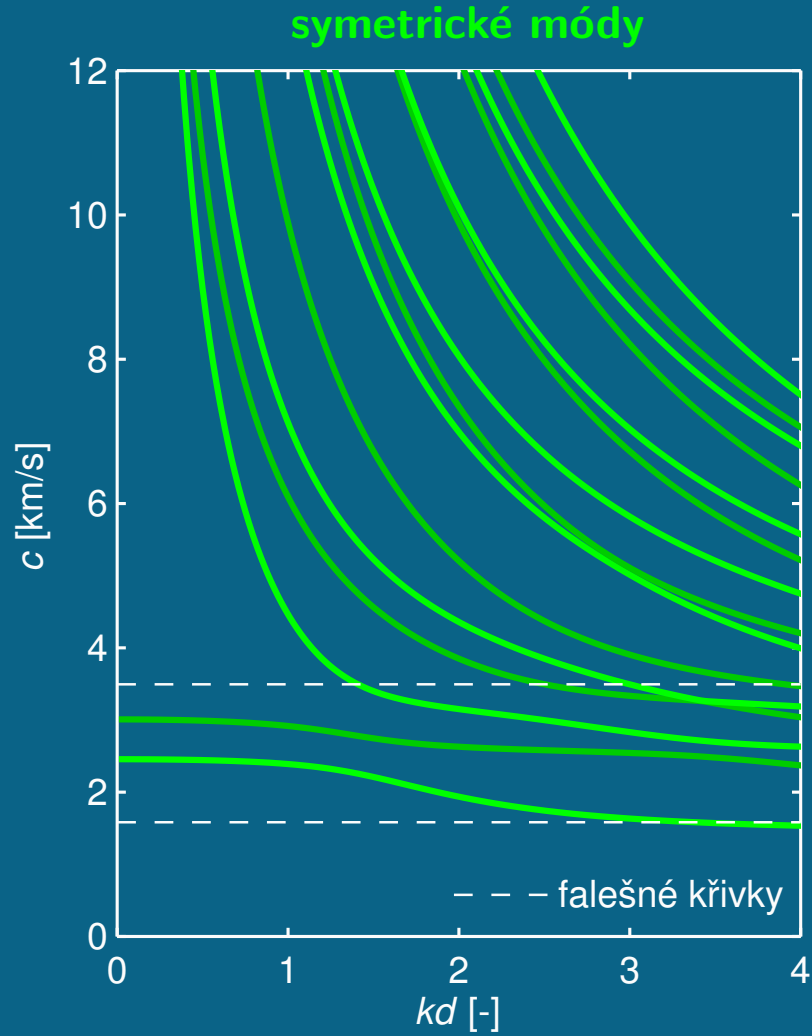
Směr šíření $\phi = 75^\circ$



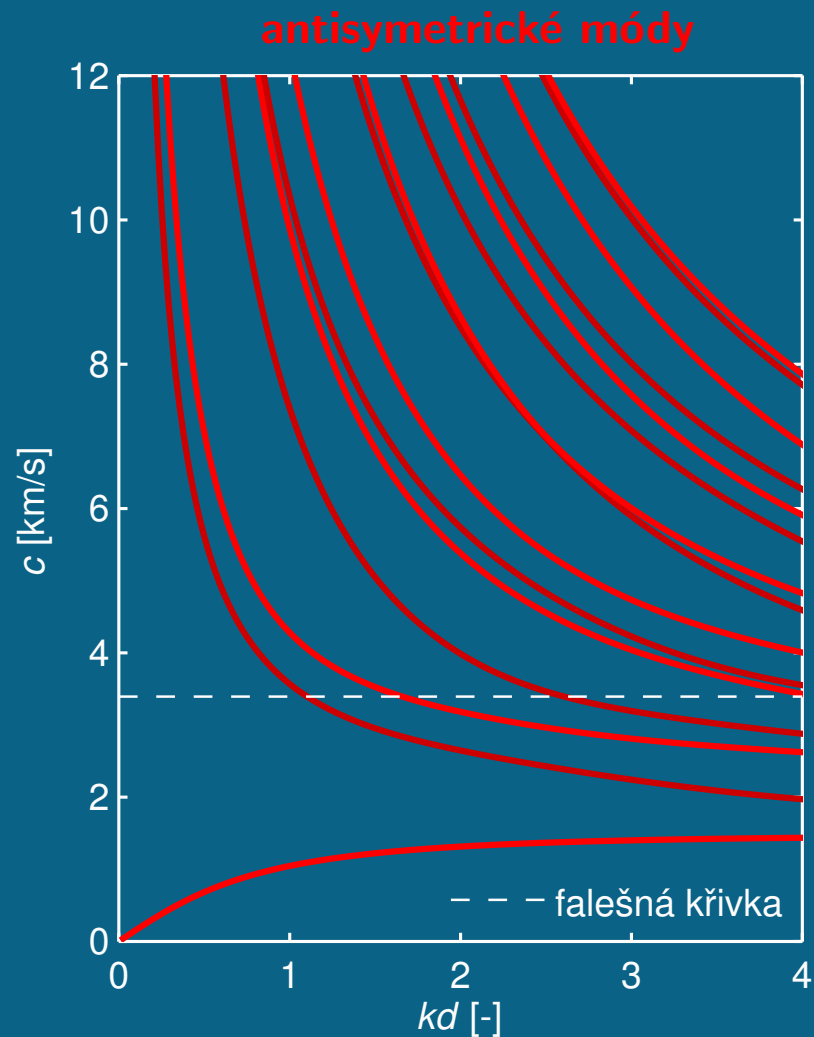
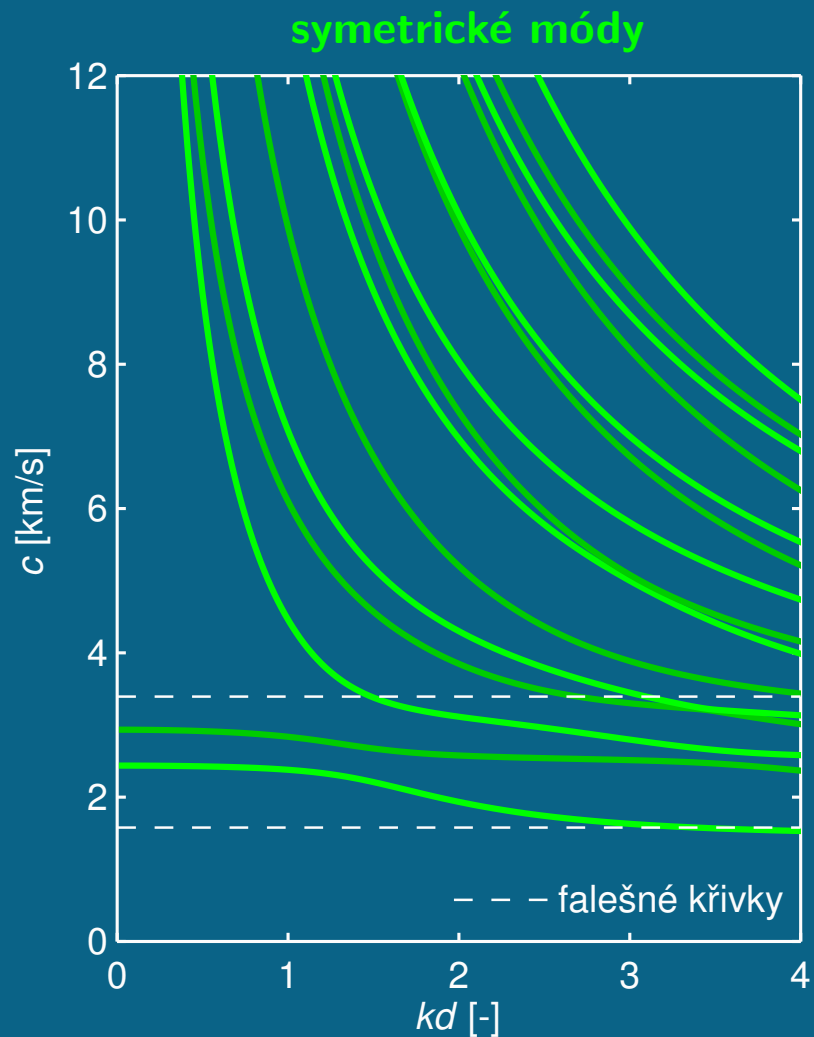
Směr šíření $\phi = 76^\circ$



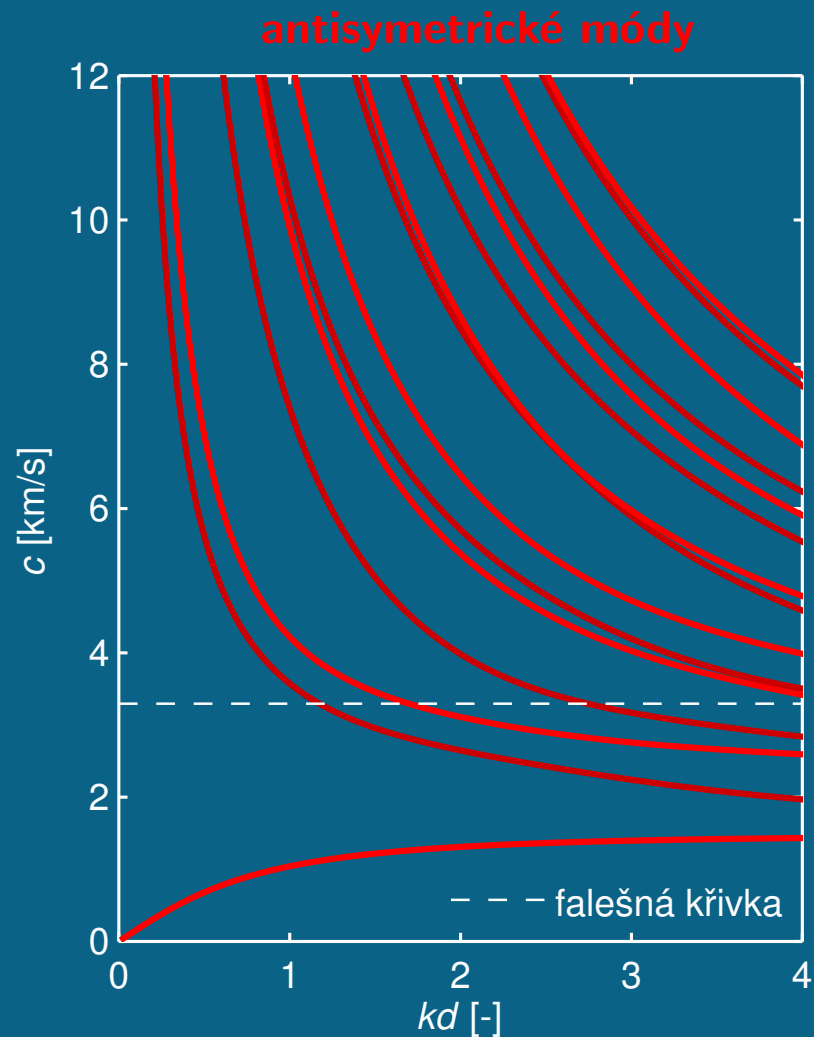
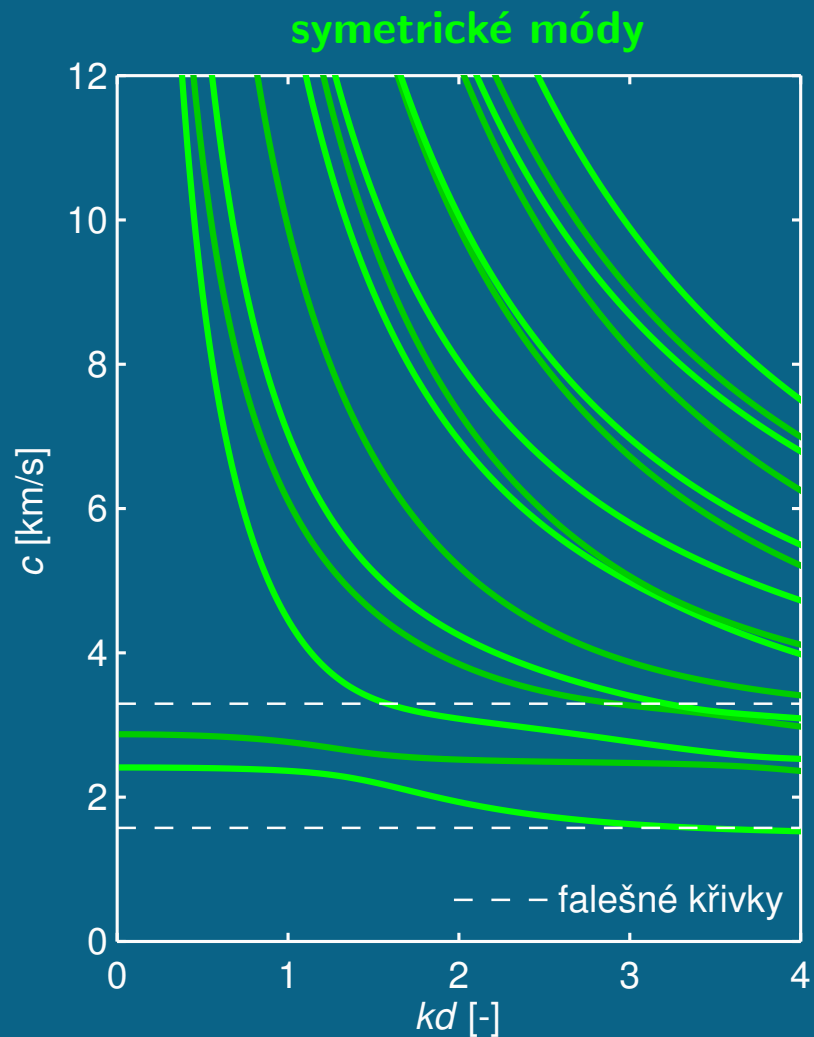
Směr šíření $\phi = 77^\circ$



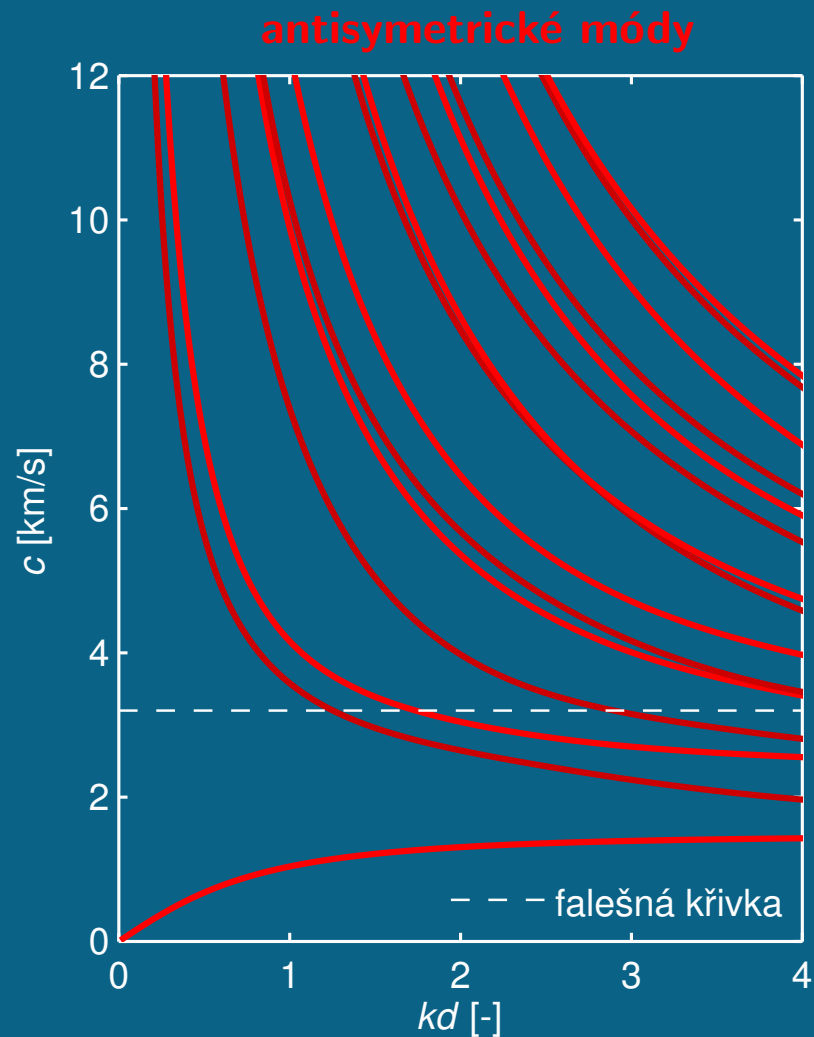
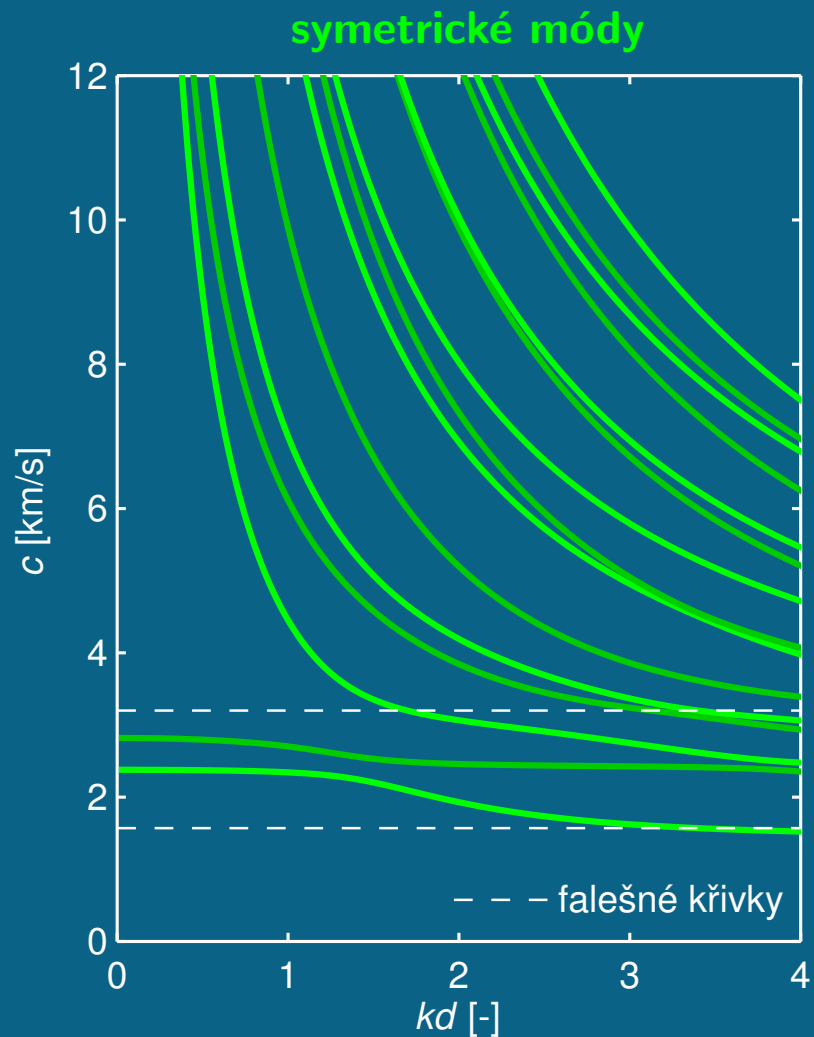
Směr šíření $\phi = 78^\circ$



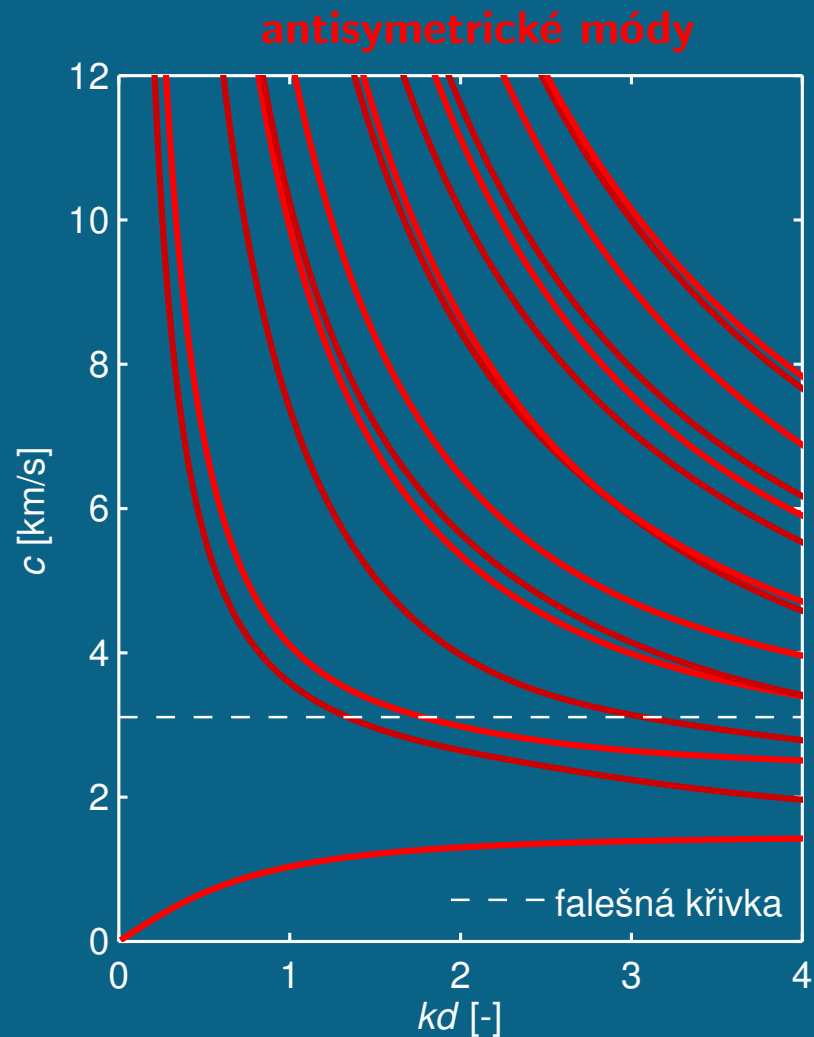
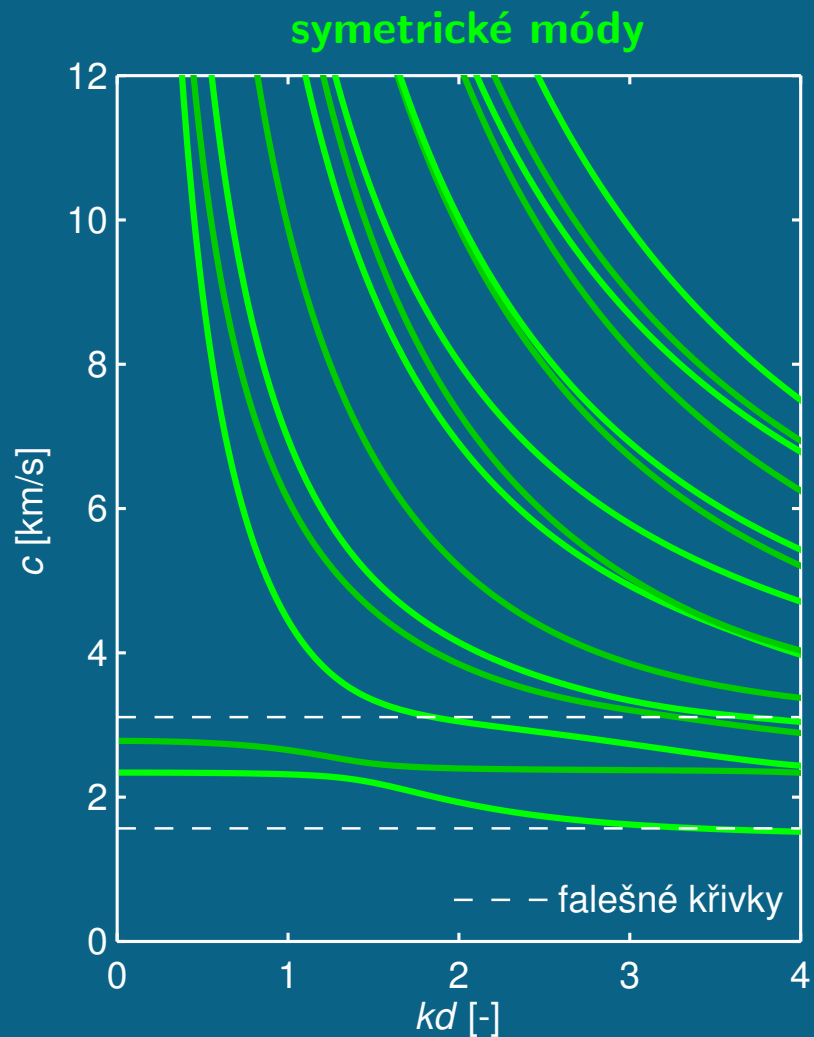
Směr šíření $\phi = 79^\circ$



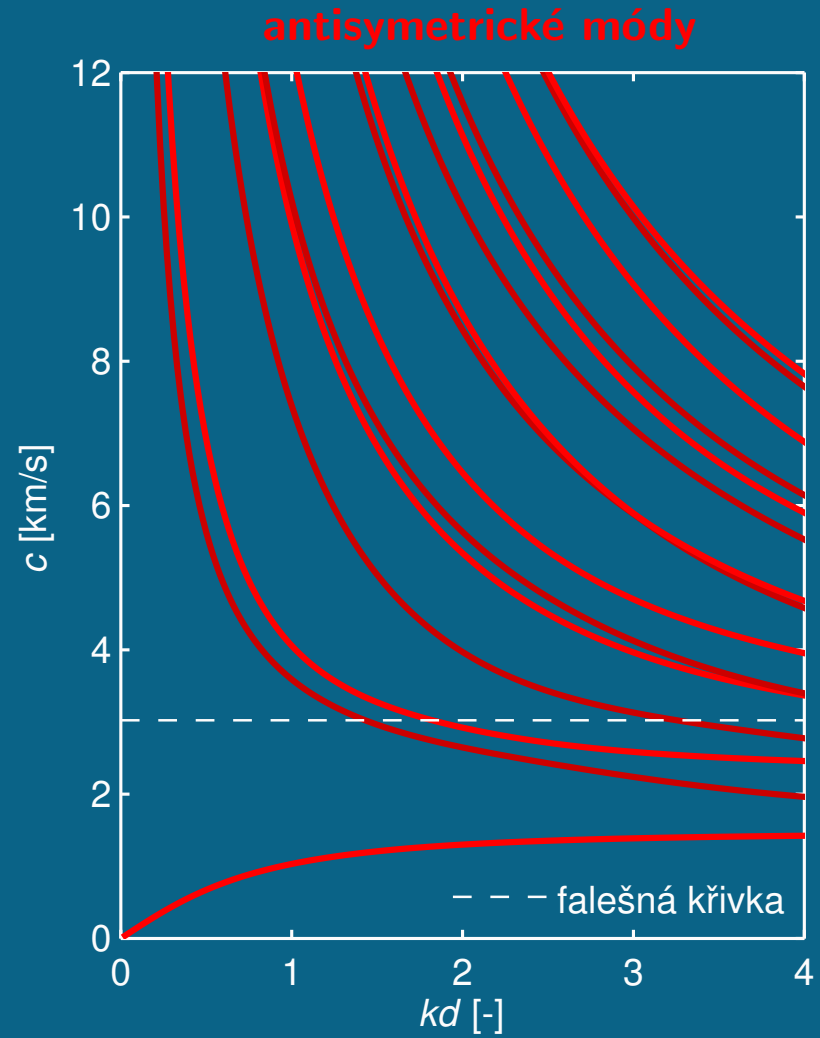
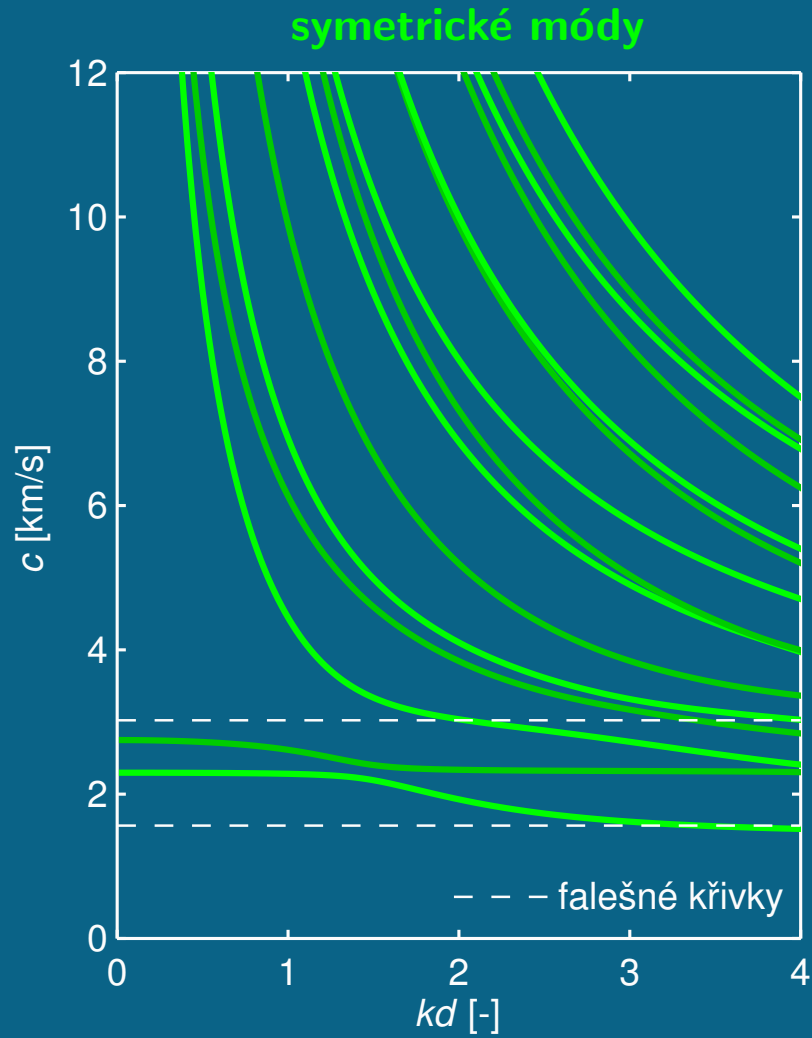
Směr šíření $\phi = 80^\circ$



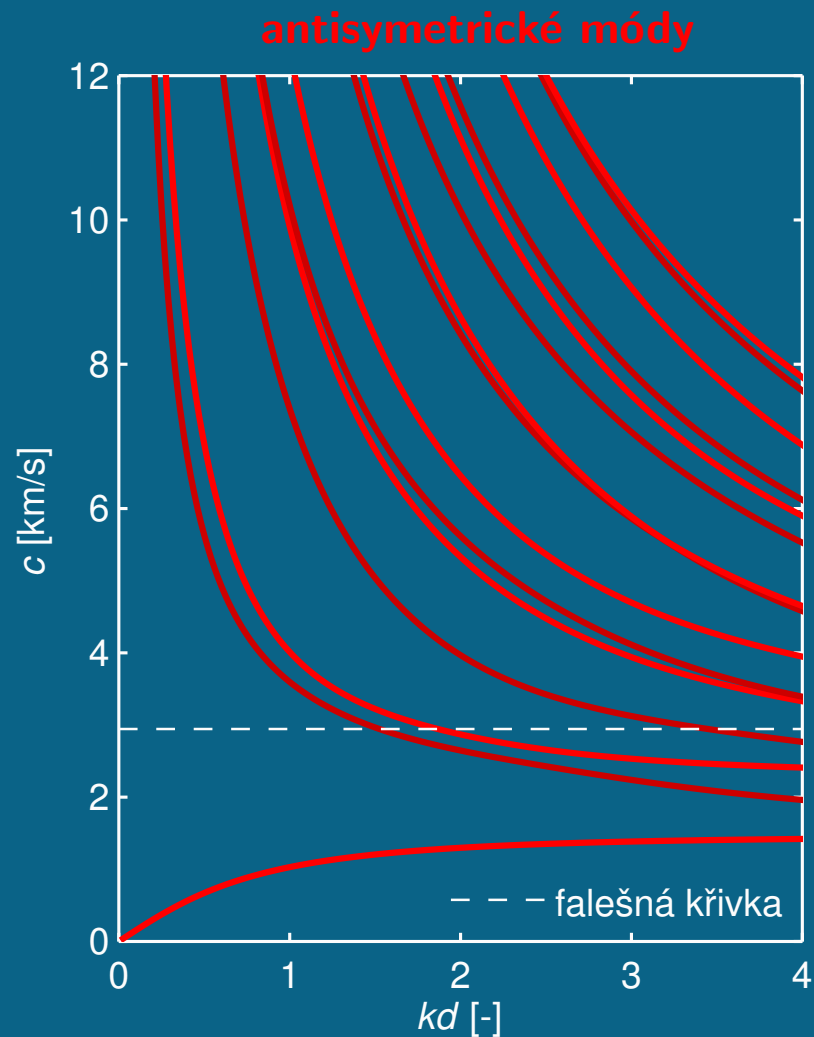
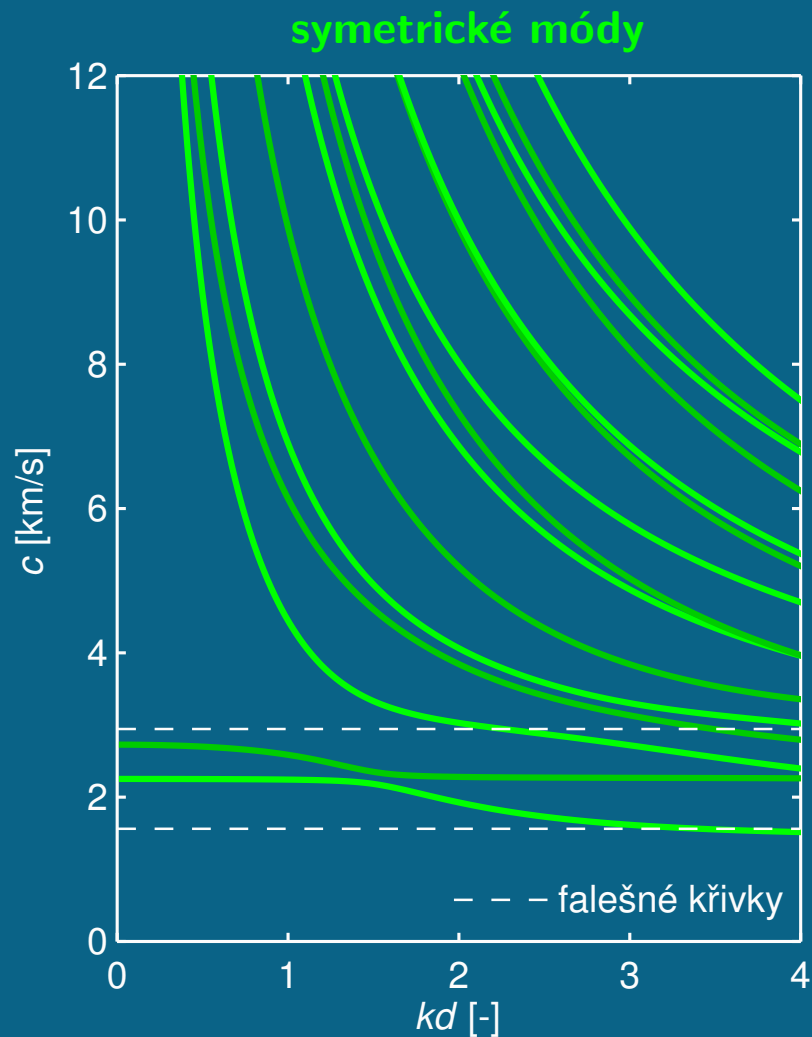
Směr šíření $\phi = 81^\circ$



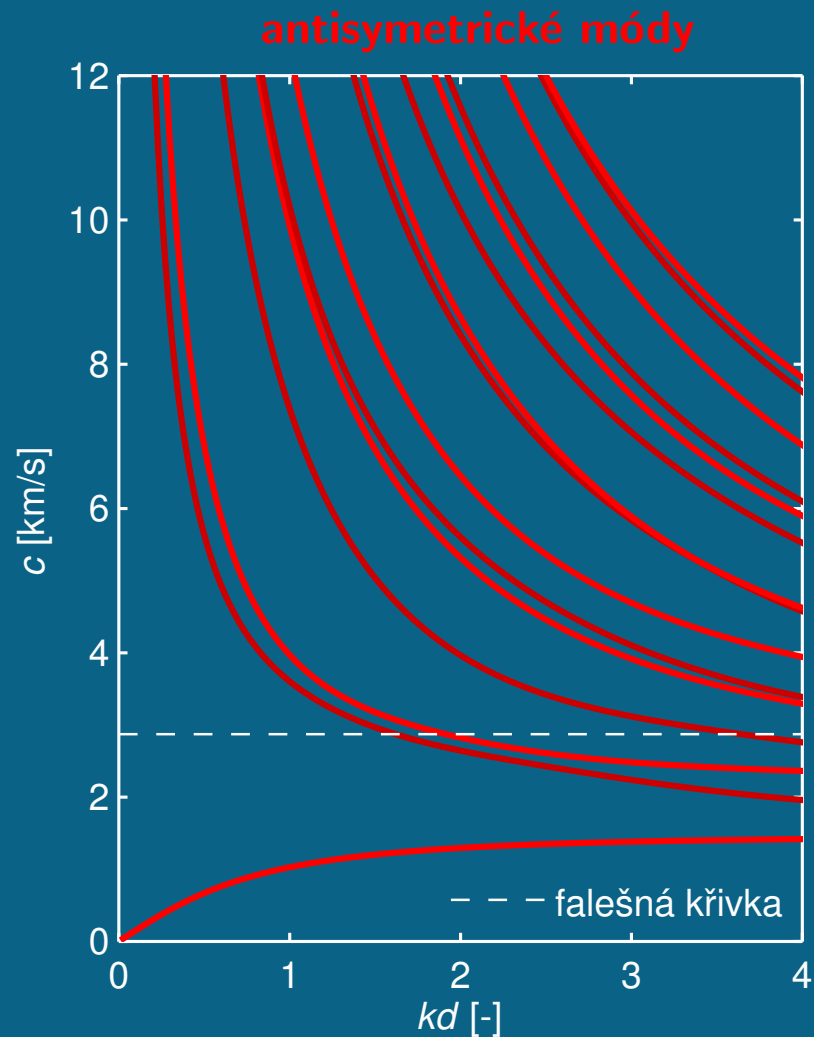
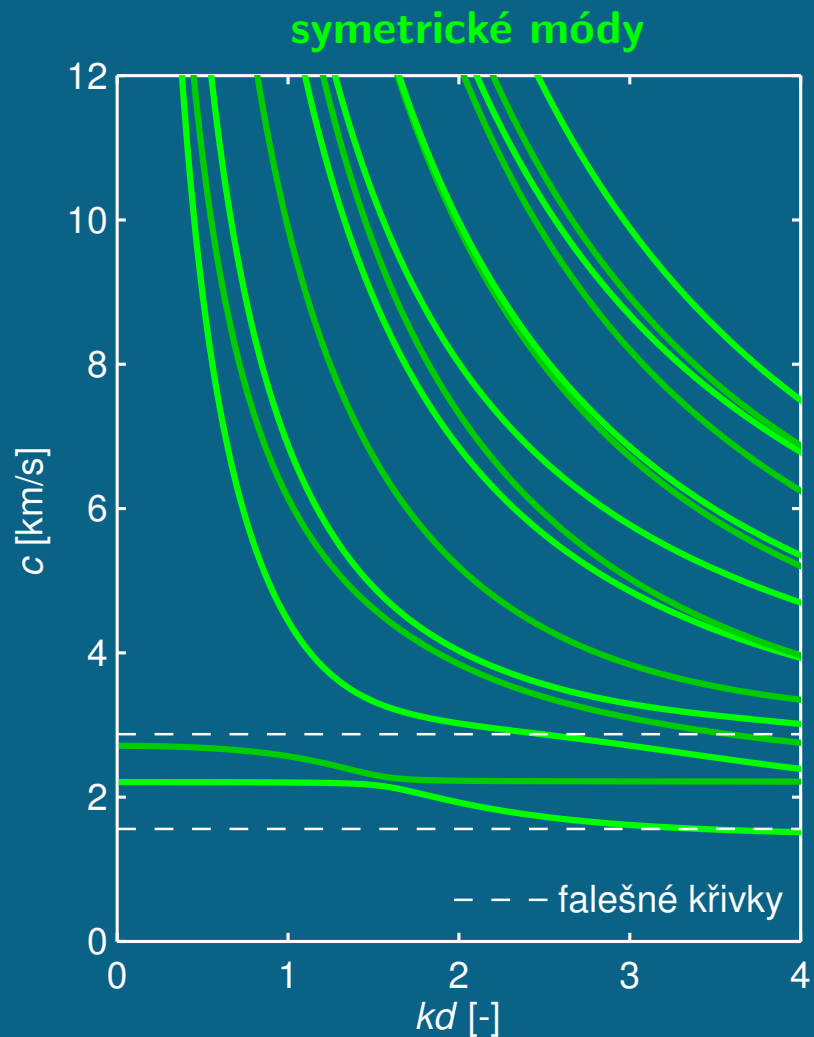
Směr šíření $\phi = 82^\circ$



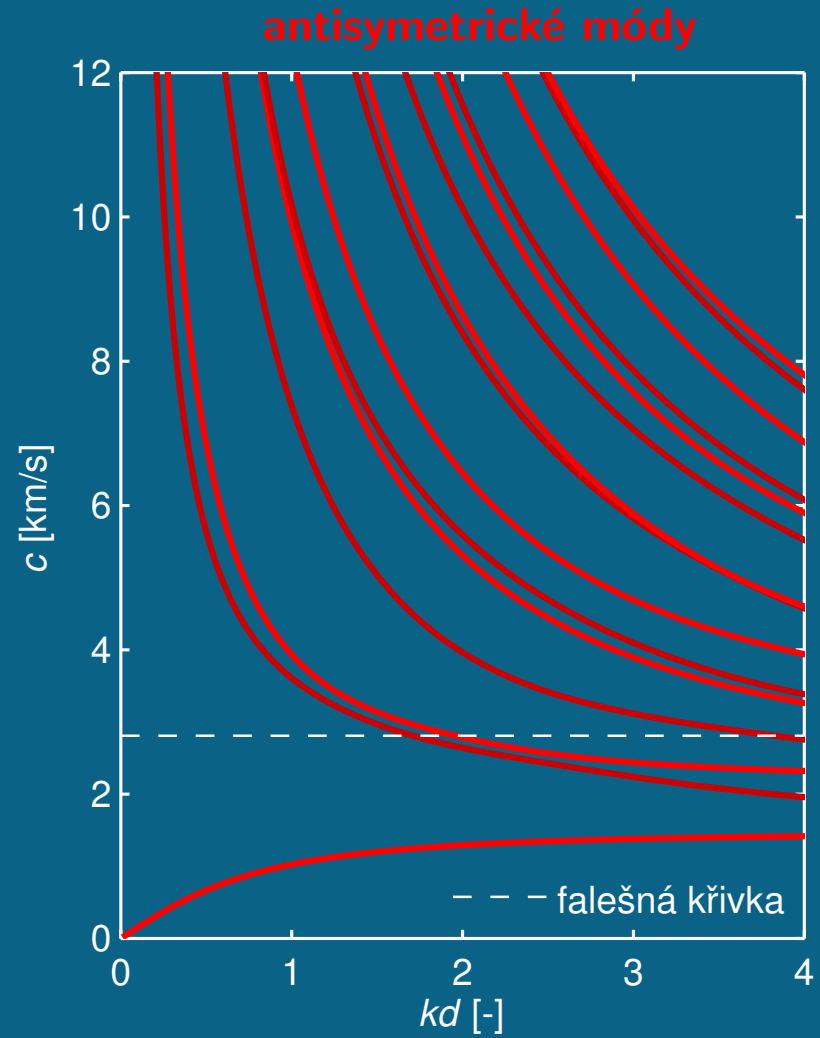
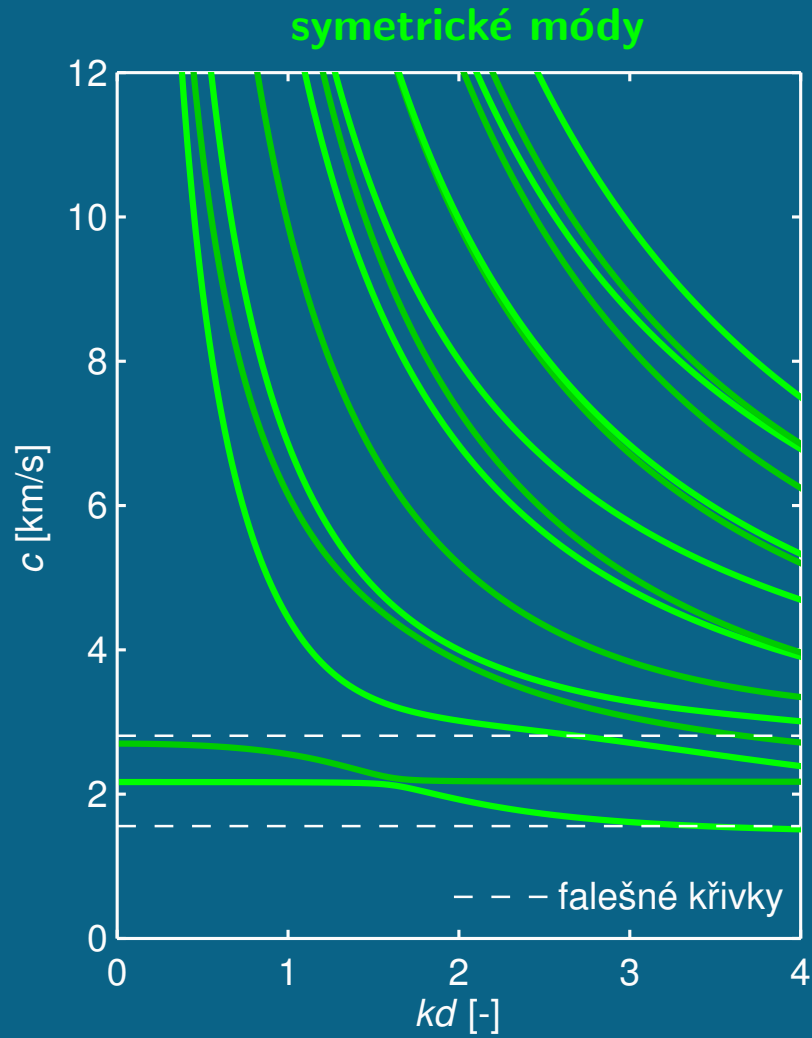
Směr šíření $\phi = 83^\circ$



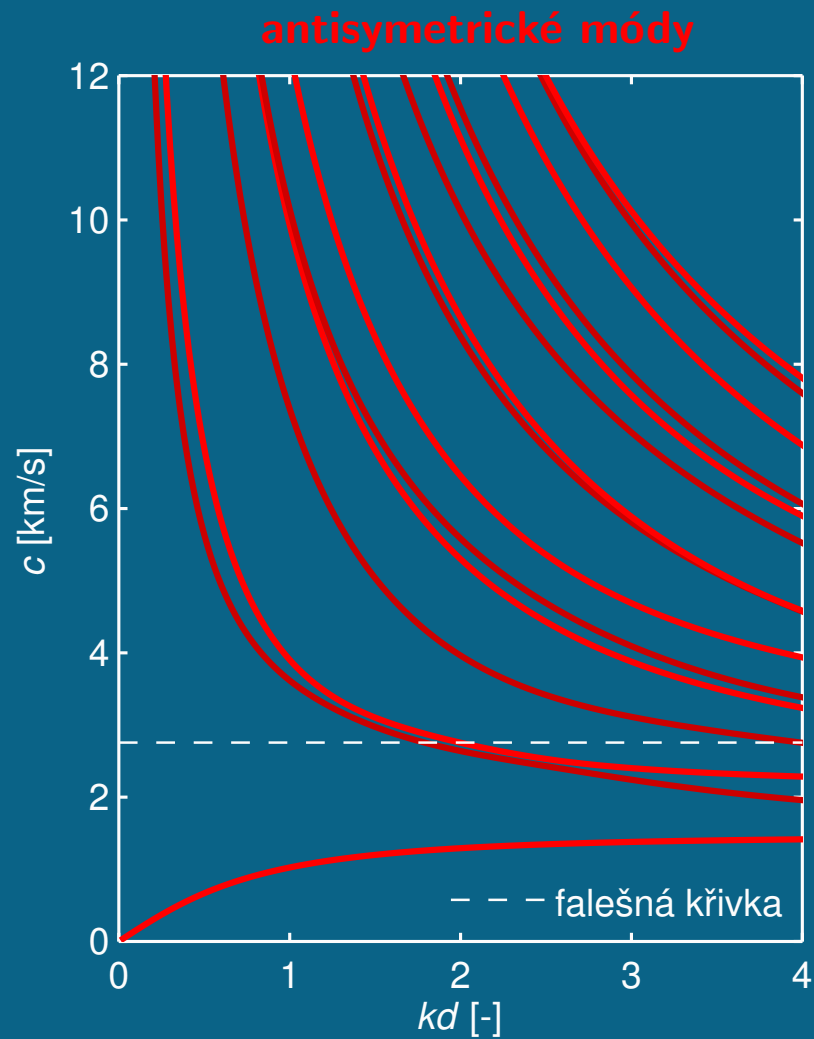
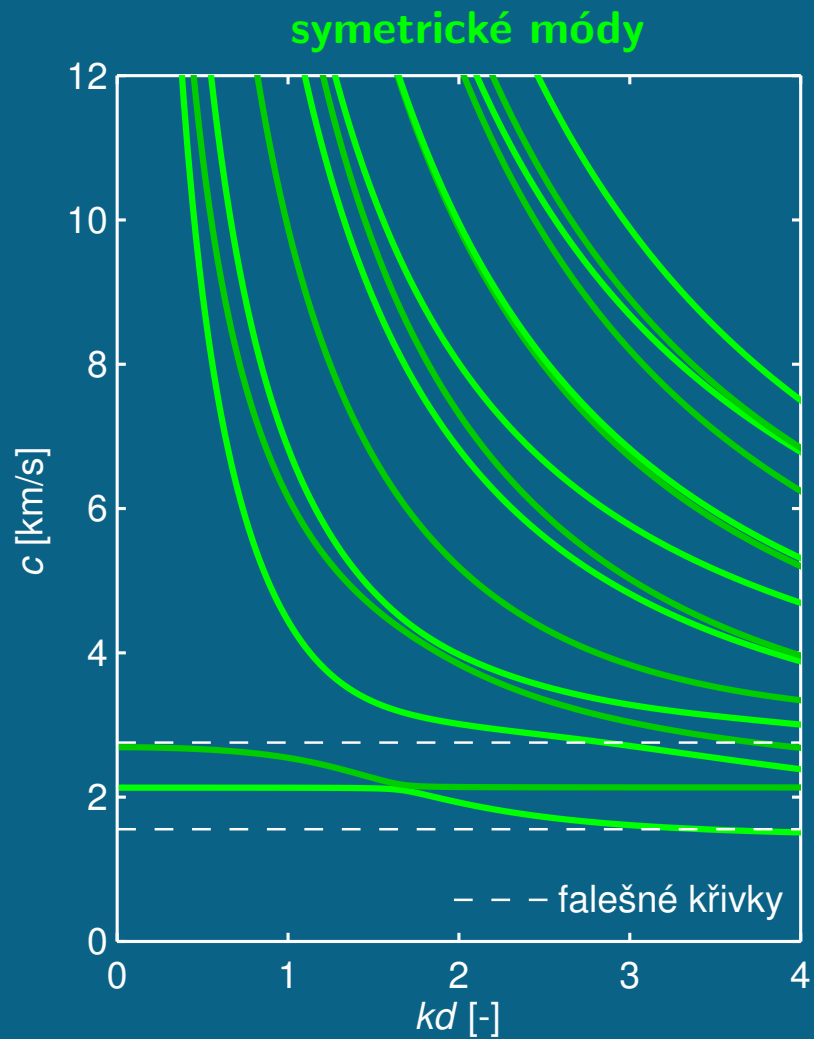
Směr šíření $\phi = 84^\circ$



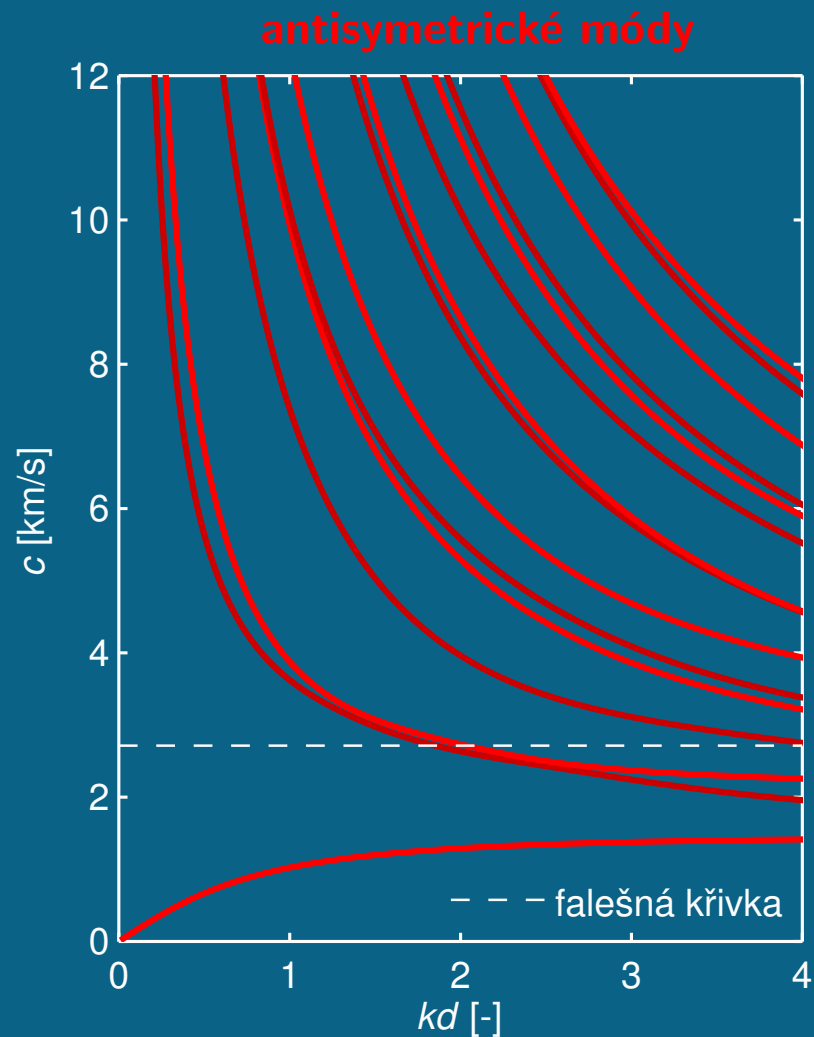
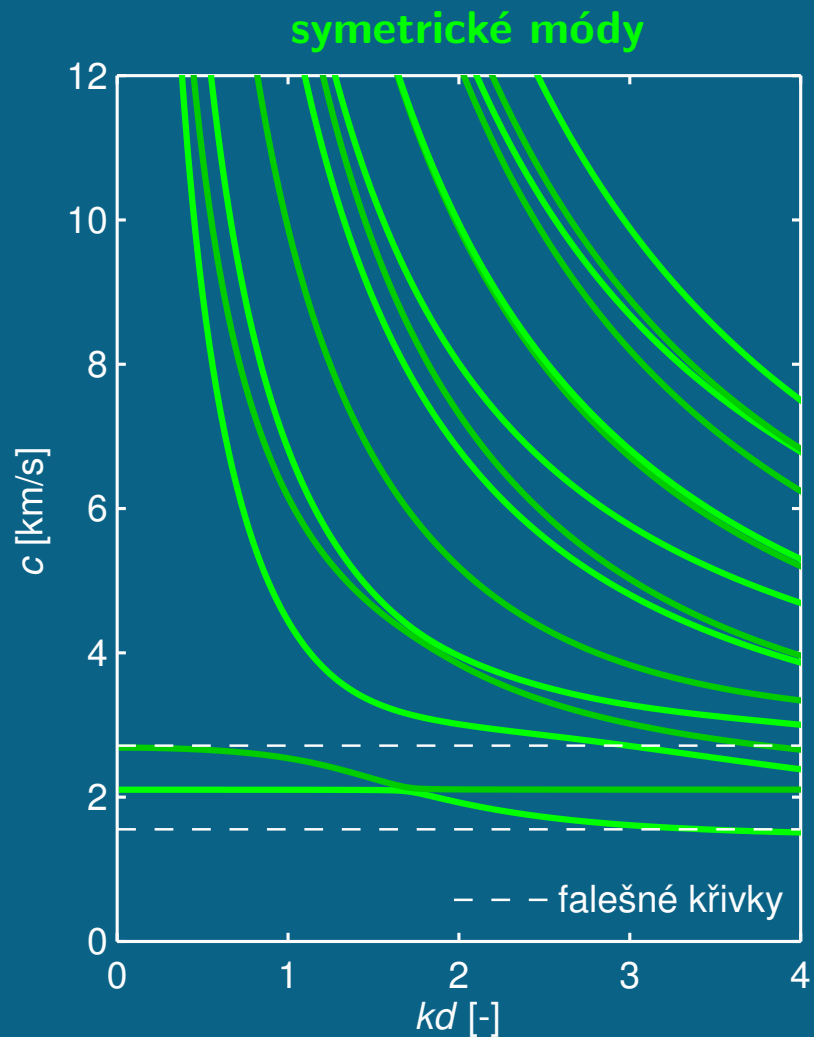
Směr šíření $\phi = 85^\circ$



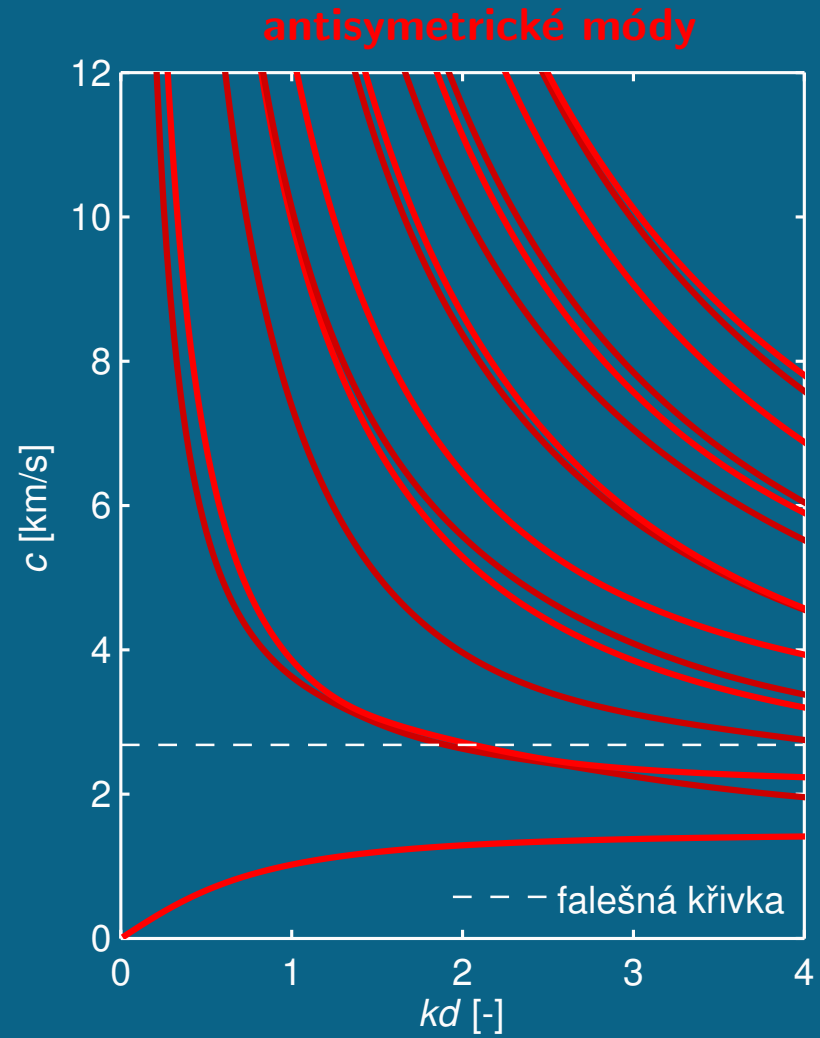
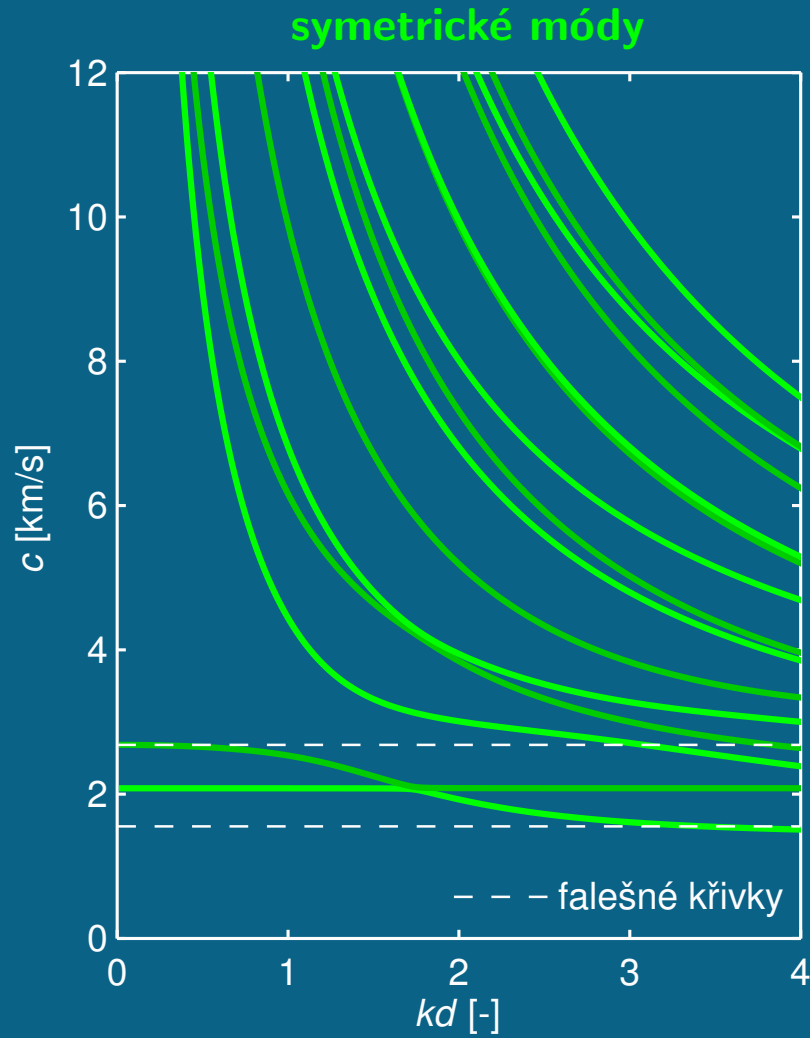
Směr šíření $\phi = 86^\circ$



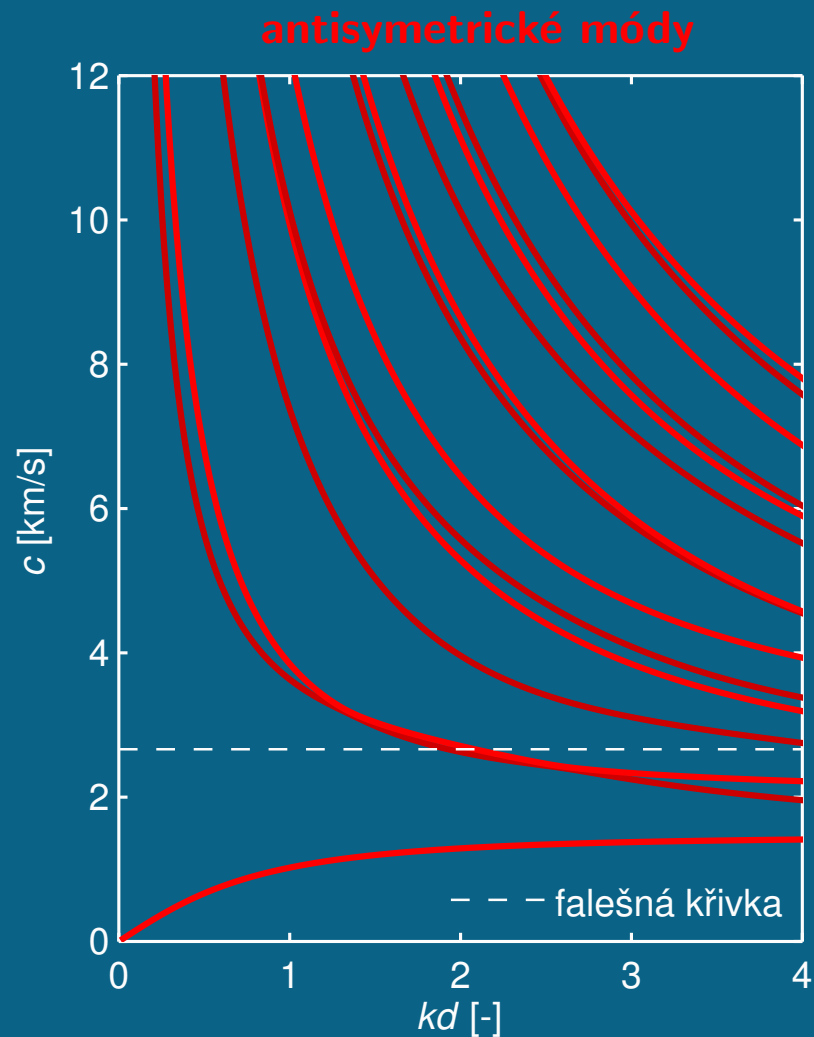
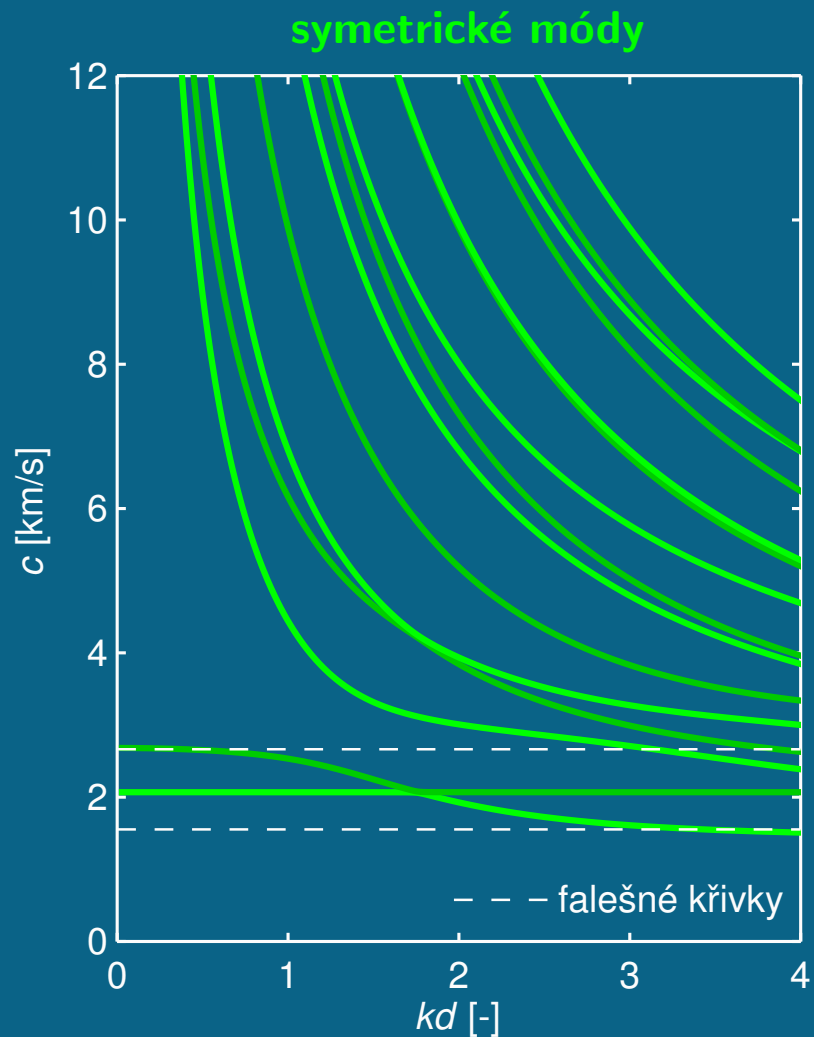
Směr šíření $\phi = 87^\circ$



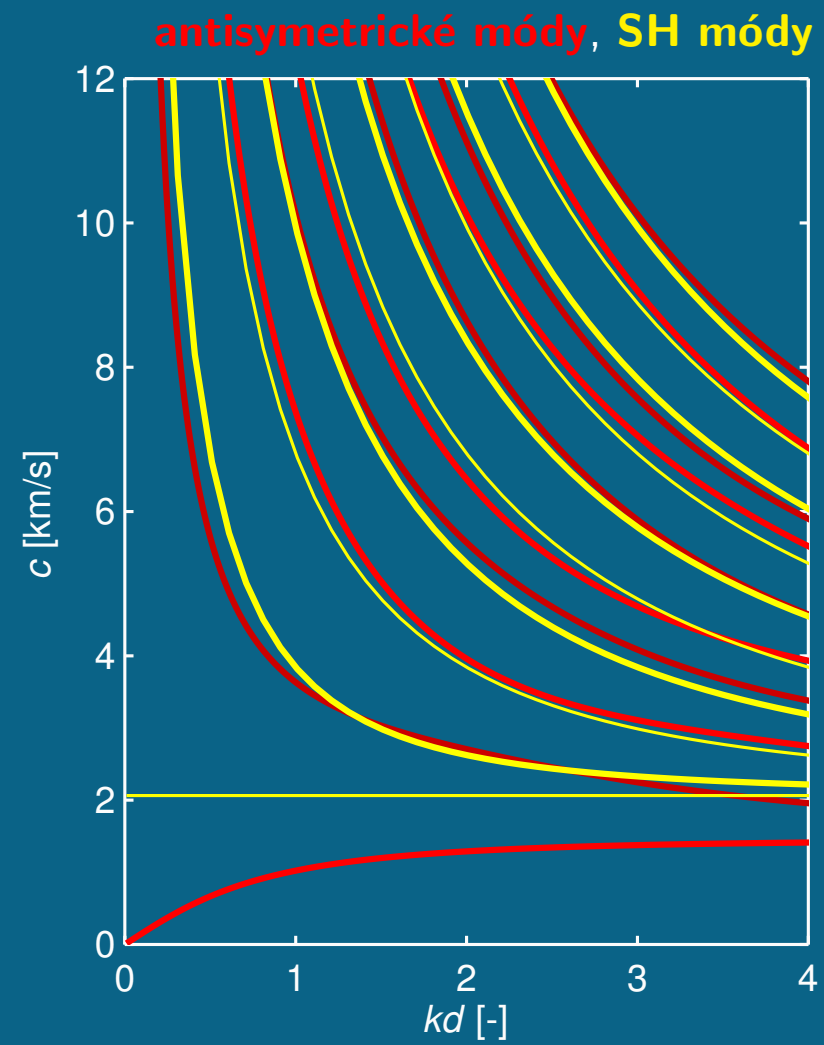
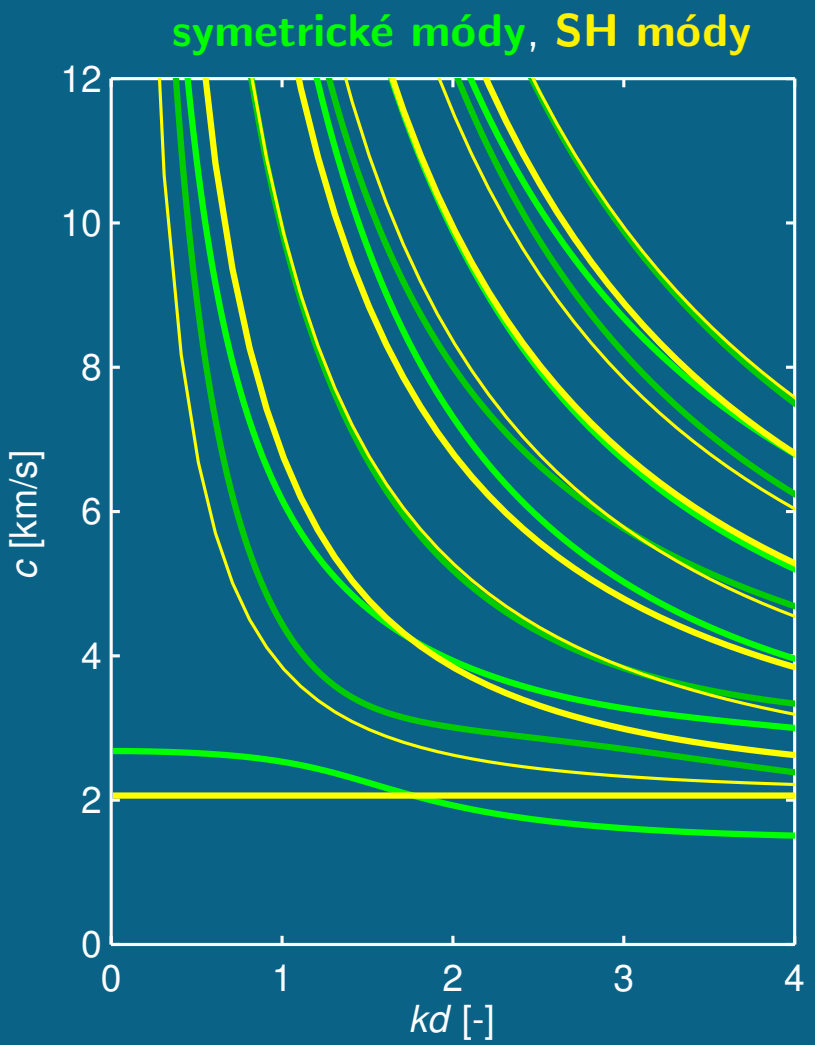
Směr šíření $\phi = 88^\circ$



Směr šíření $\phi = 89^\circ$



Směr šíření $\phi = 90^\circ$

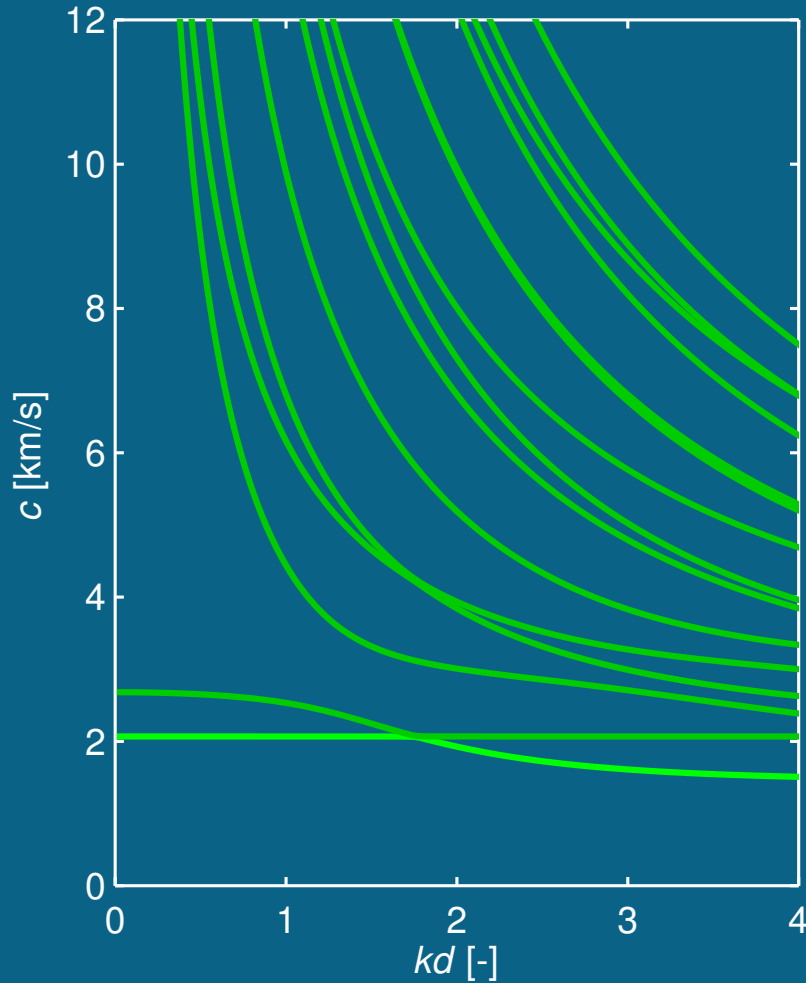


Symetrické módy pro směr šíření

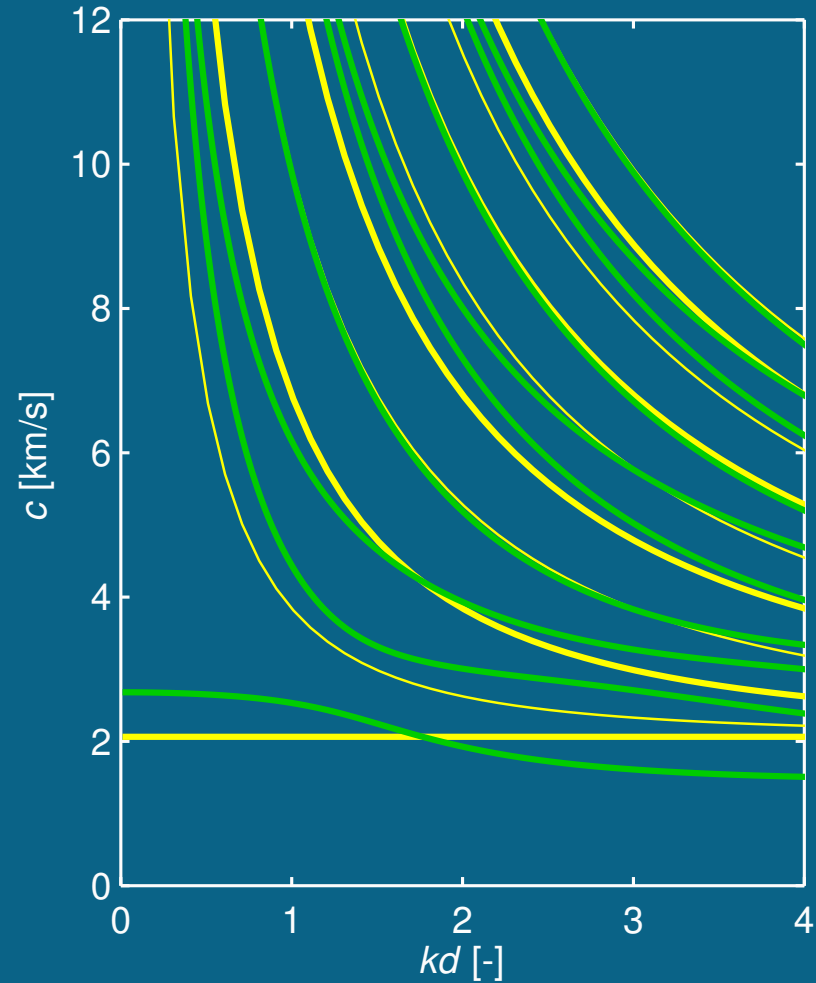
$\phi = 89^\circ$

$\phi = 90^\circ$

symetrické módy

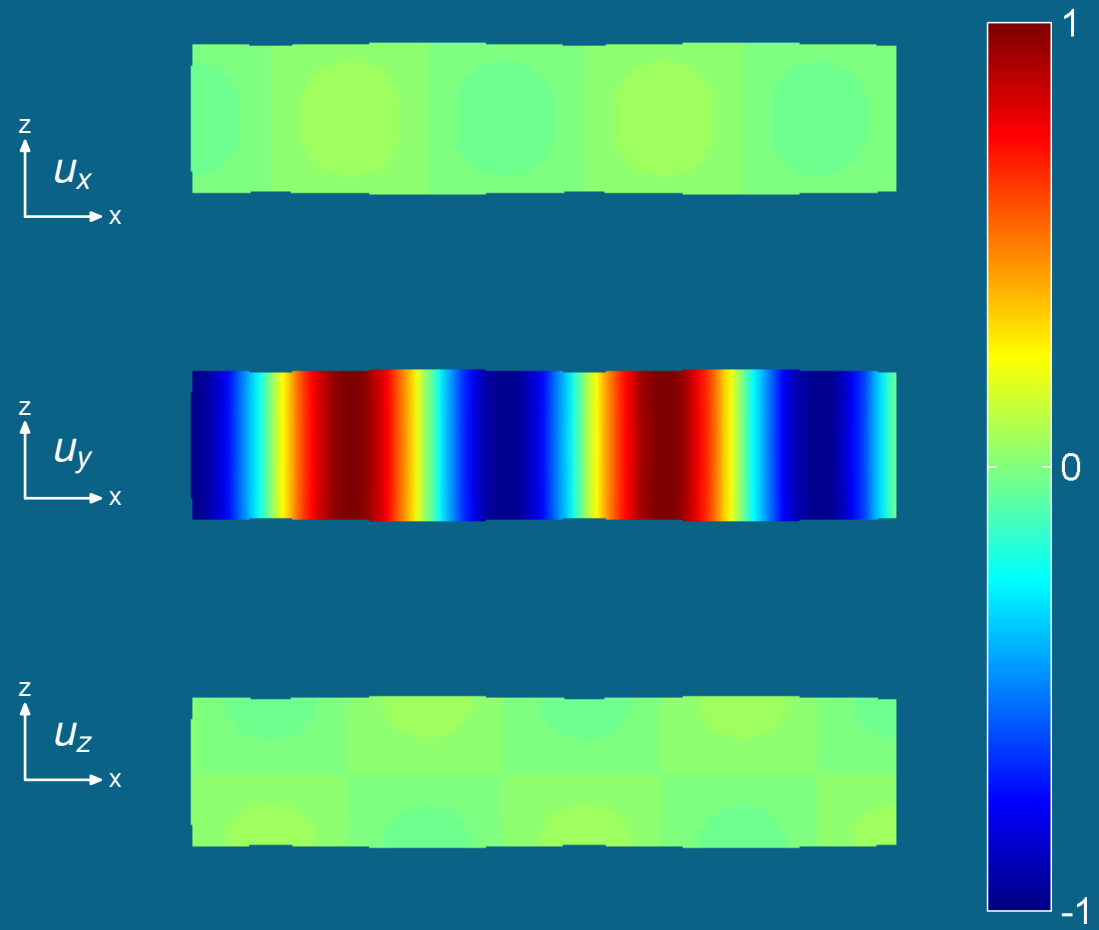
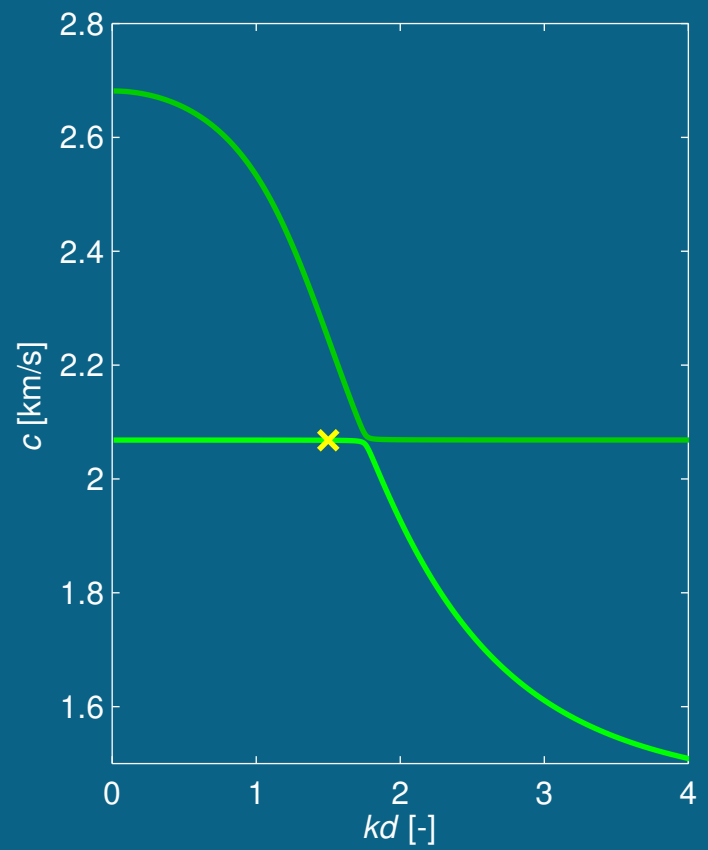


symetrické módy, SH módy



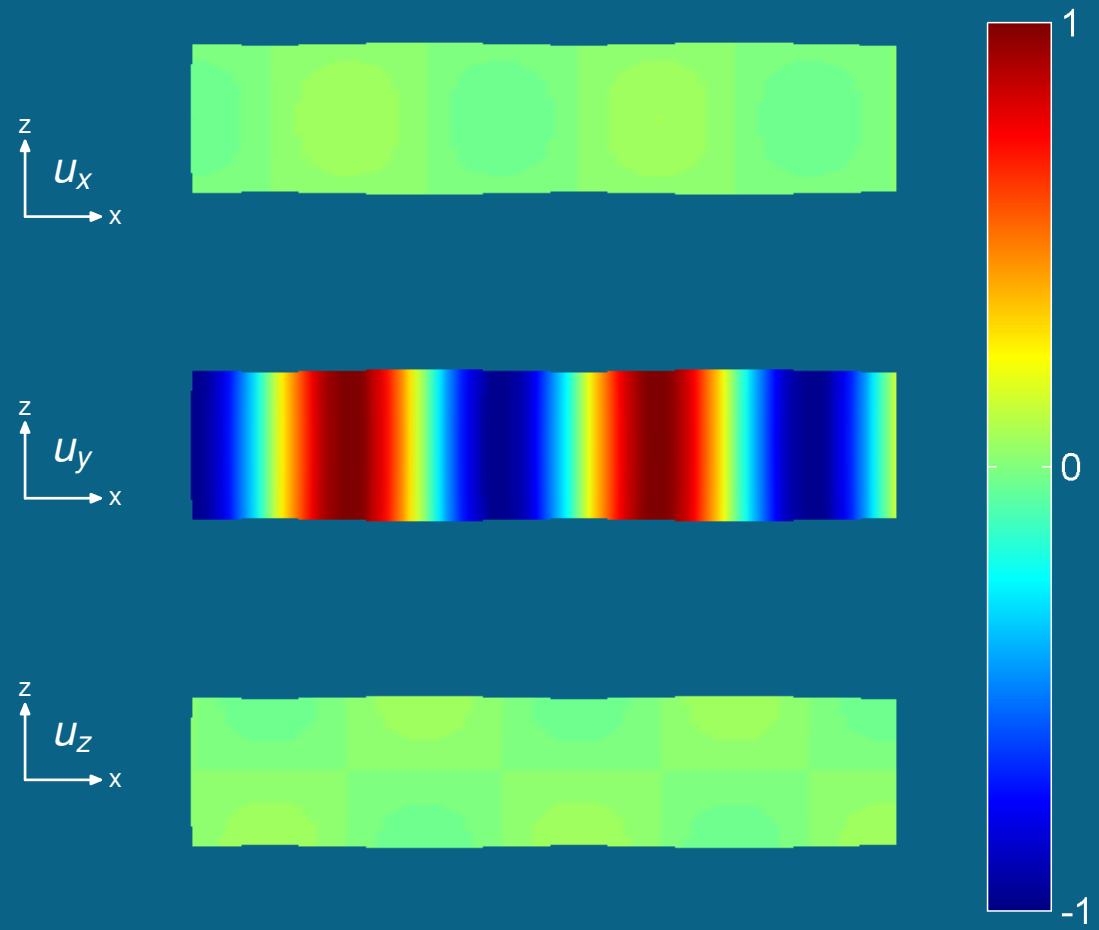
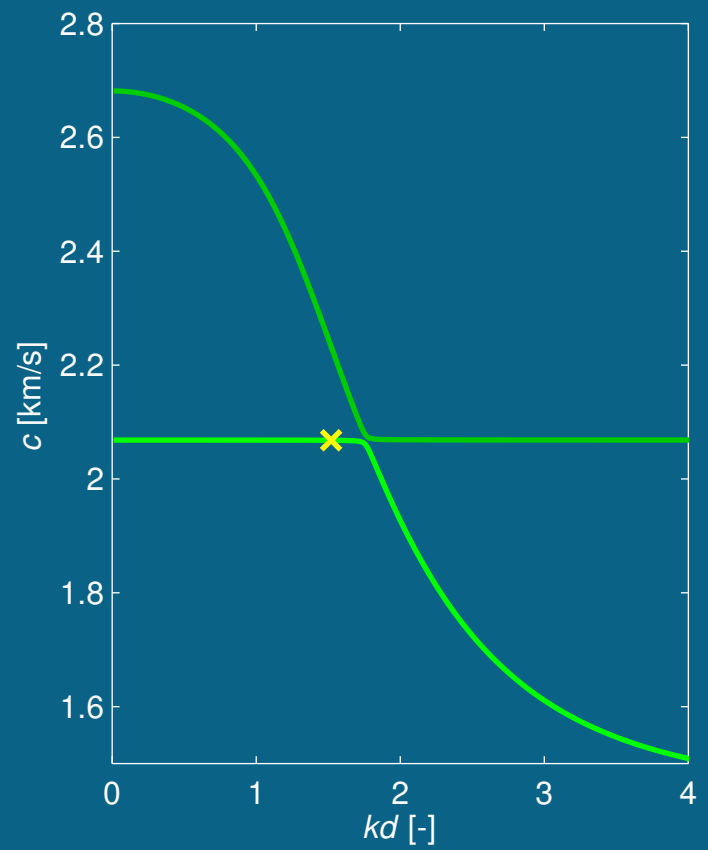
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.50$



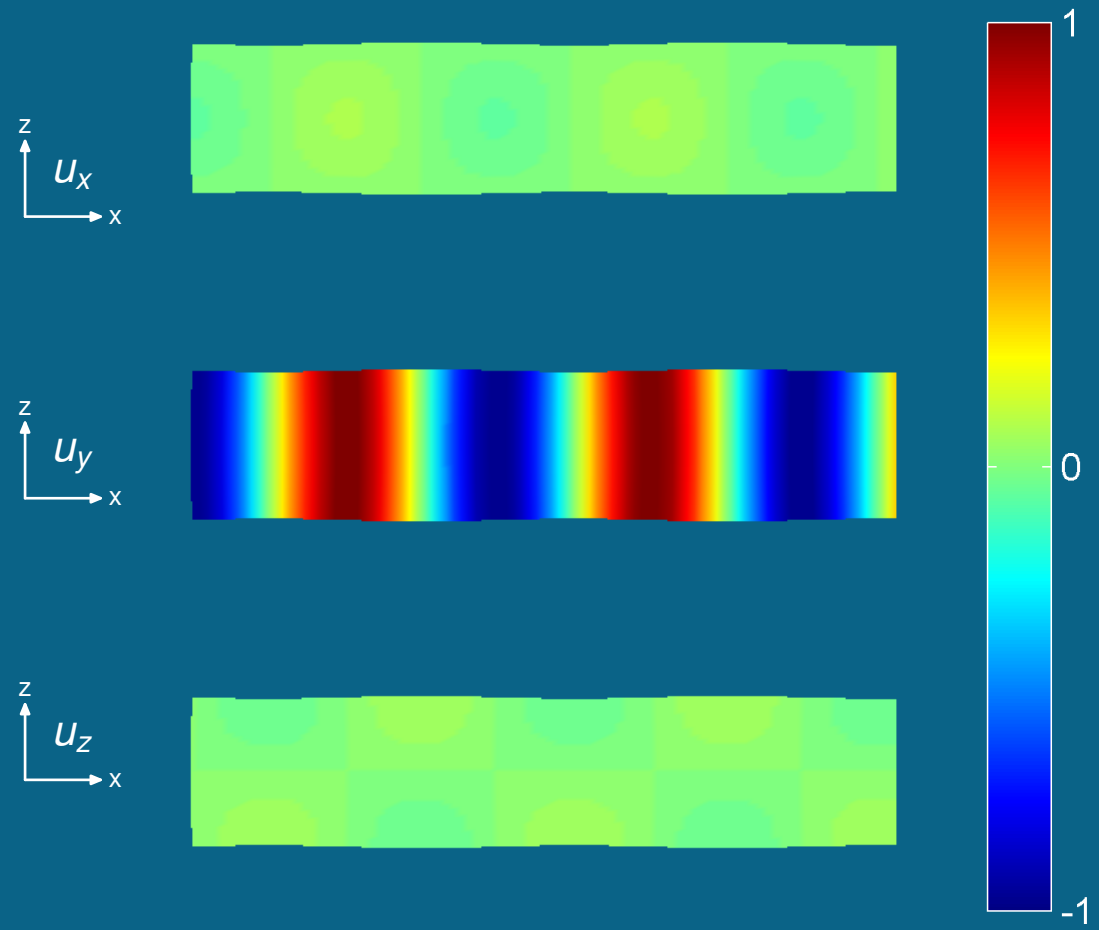
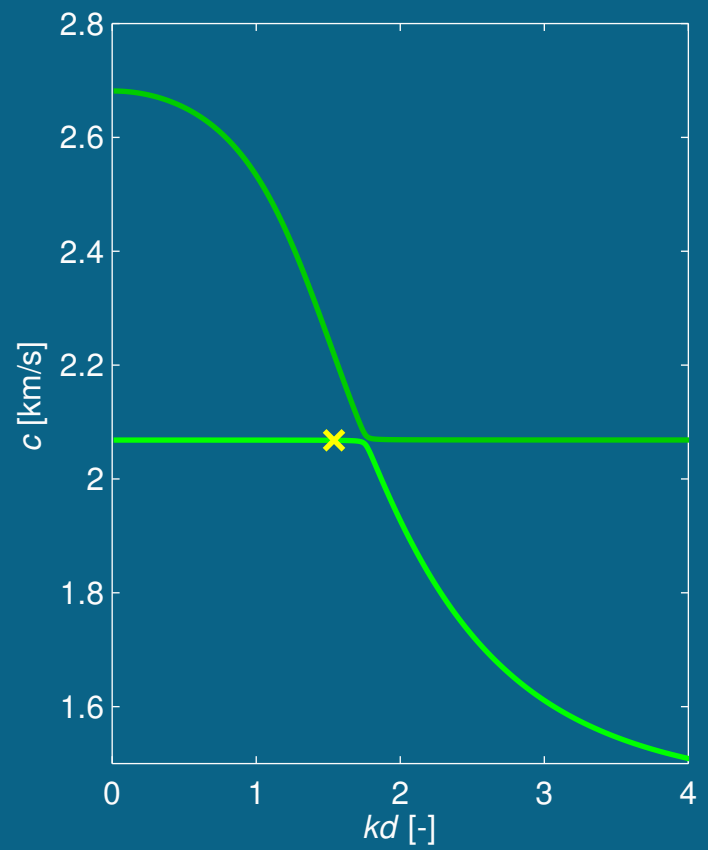
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.52$



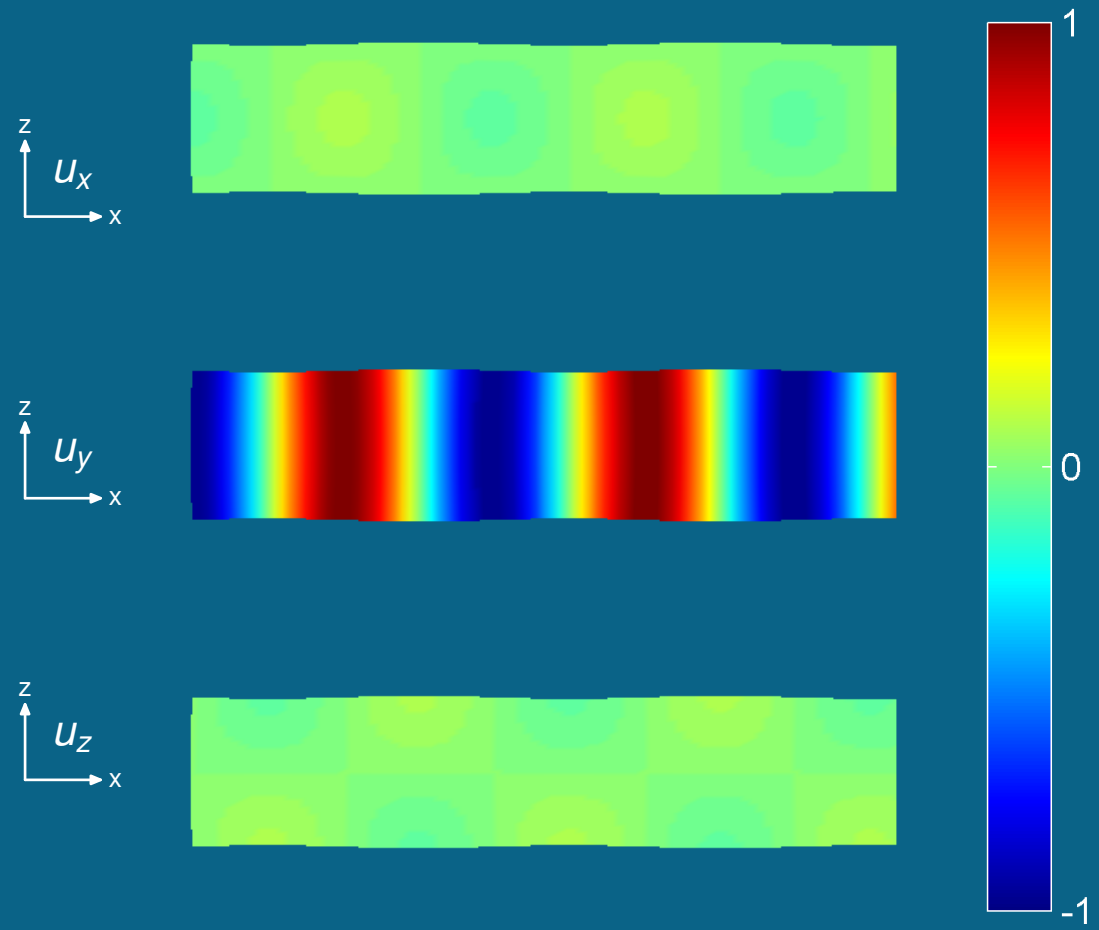
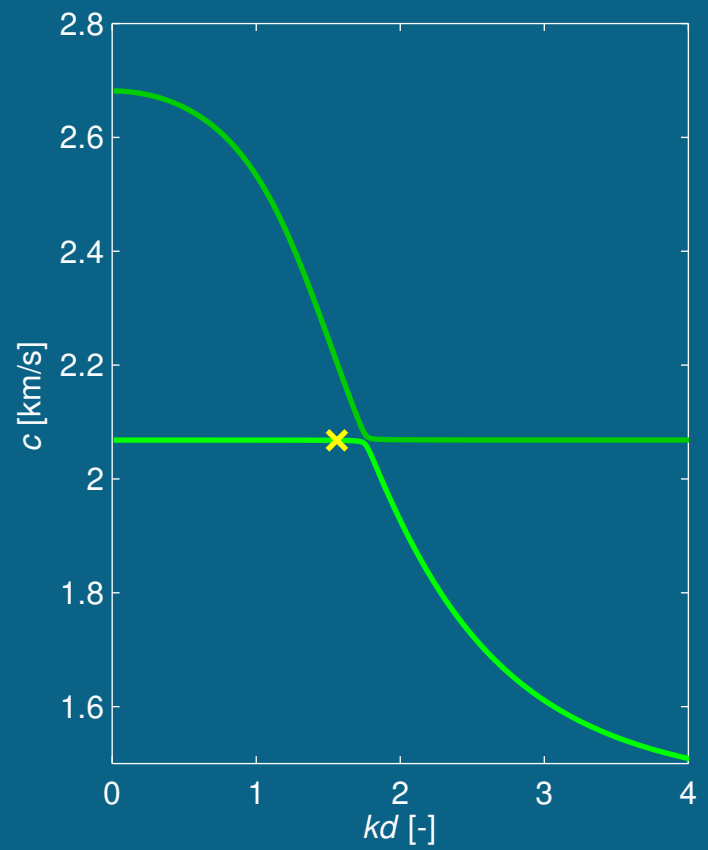
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.54$



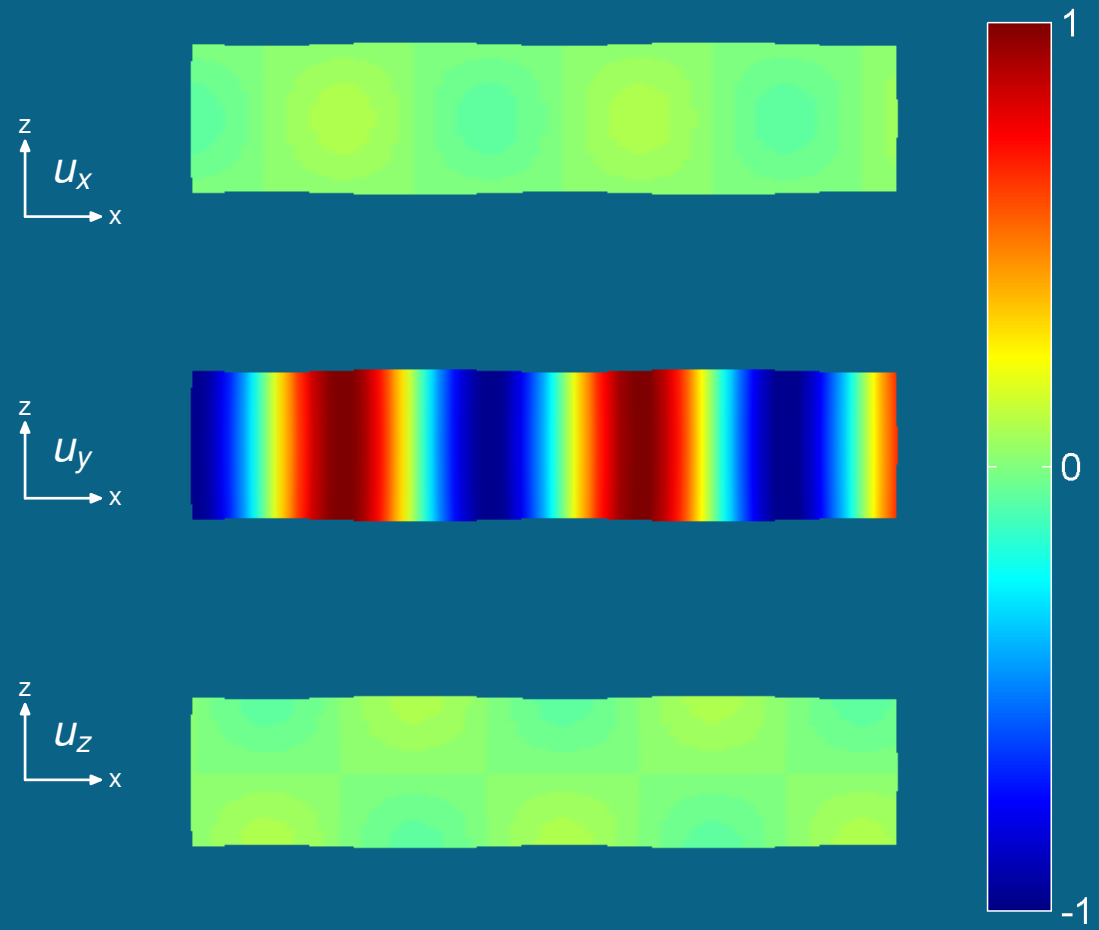
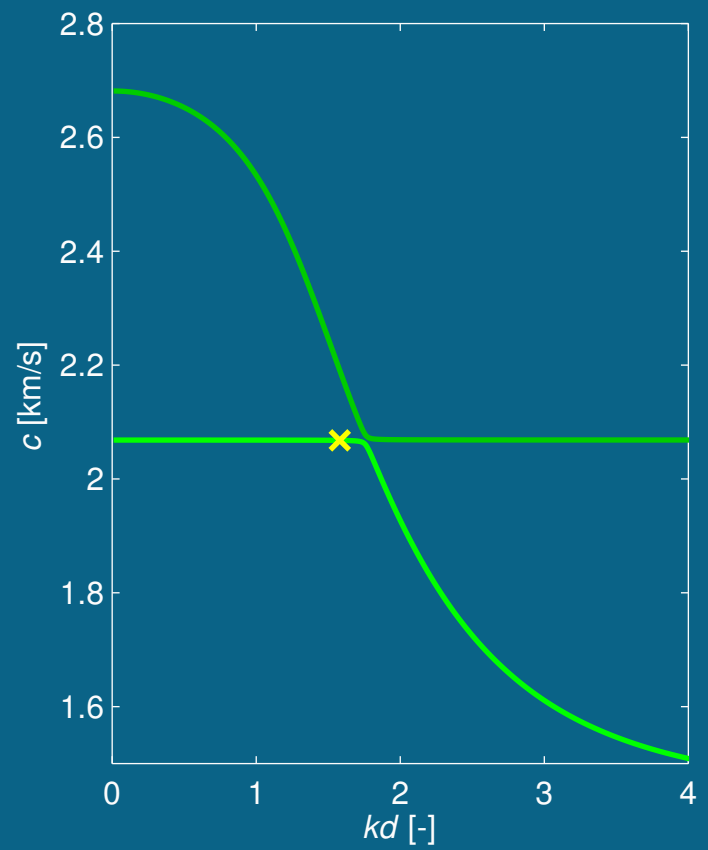
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.56$



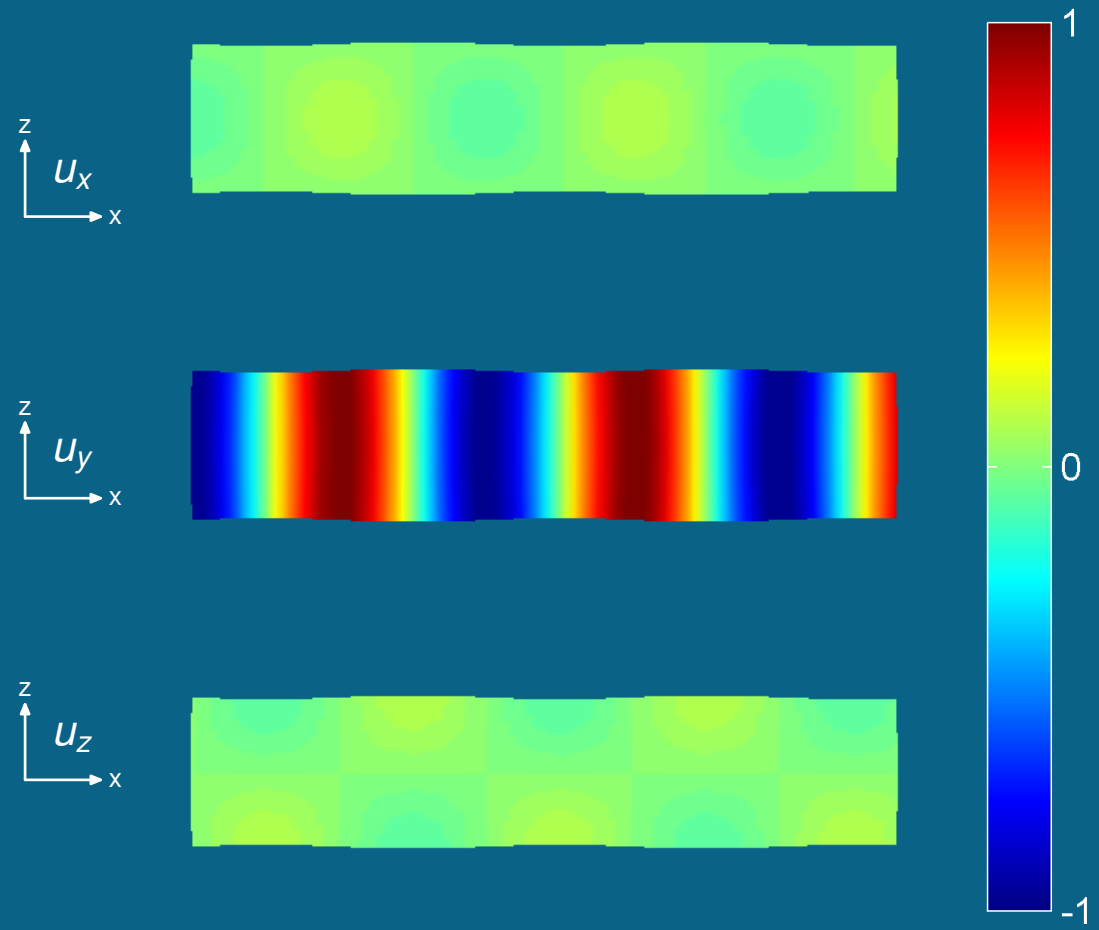
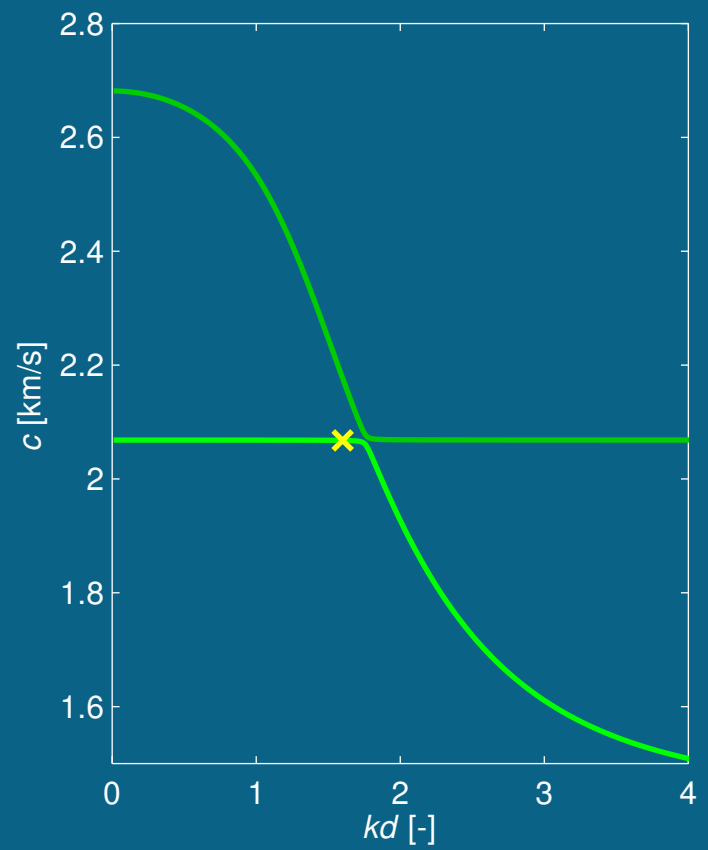
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.58$



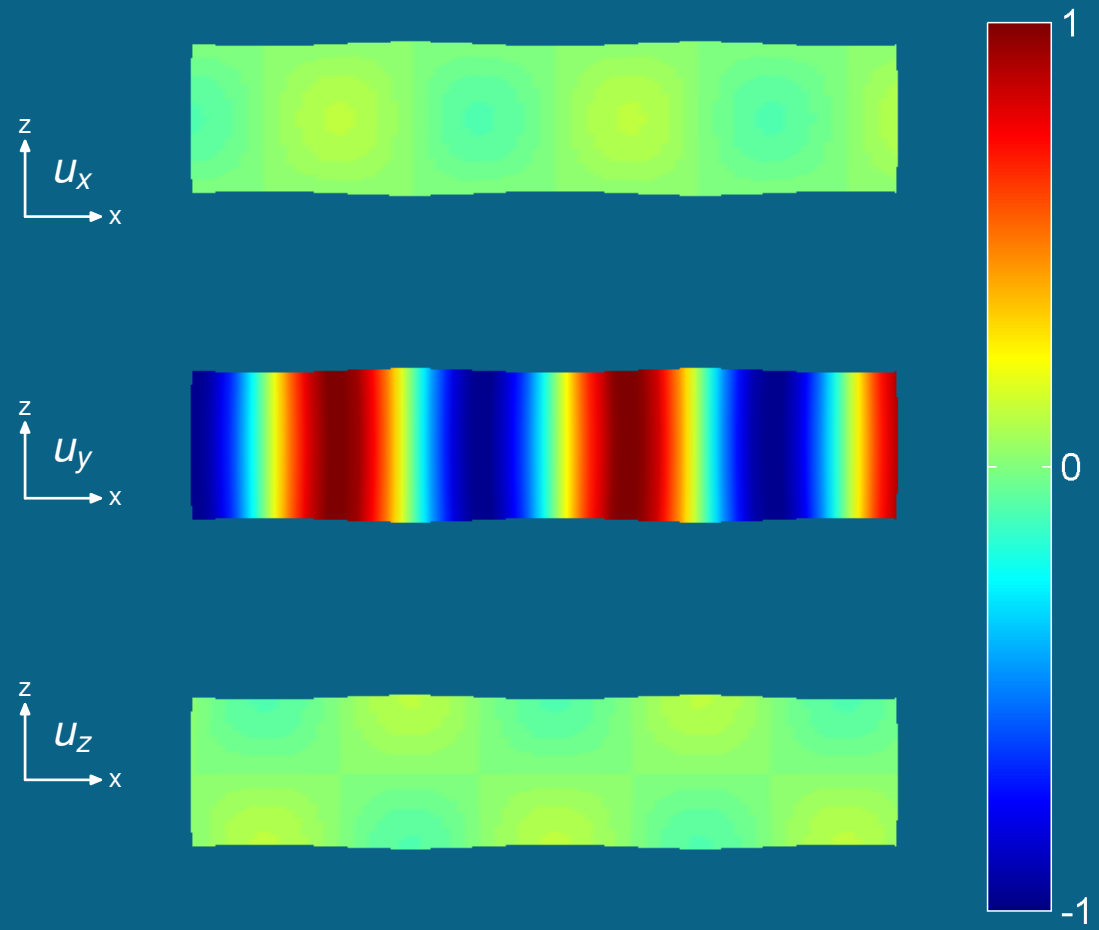
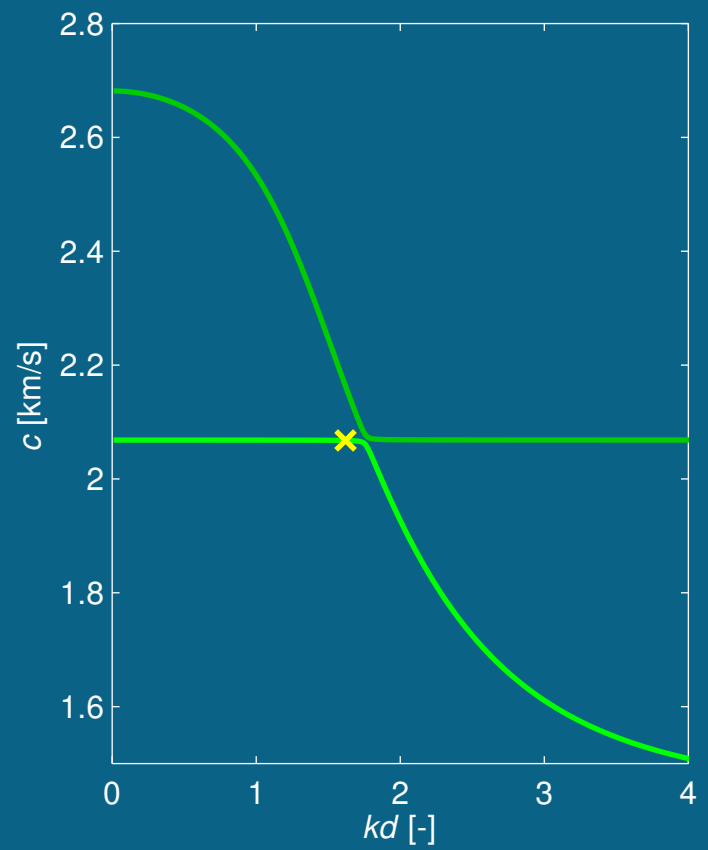
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.60$



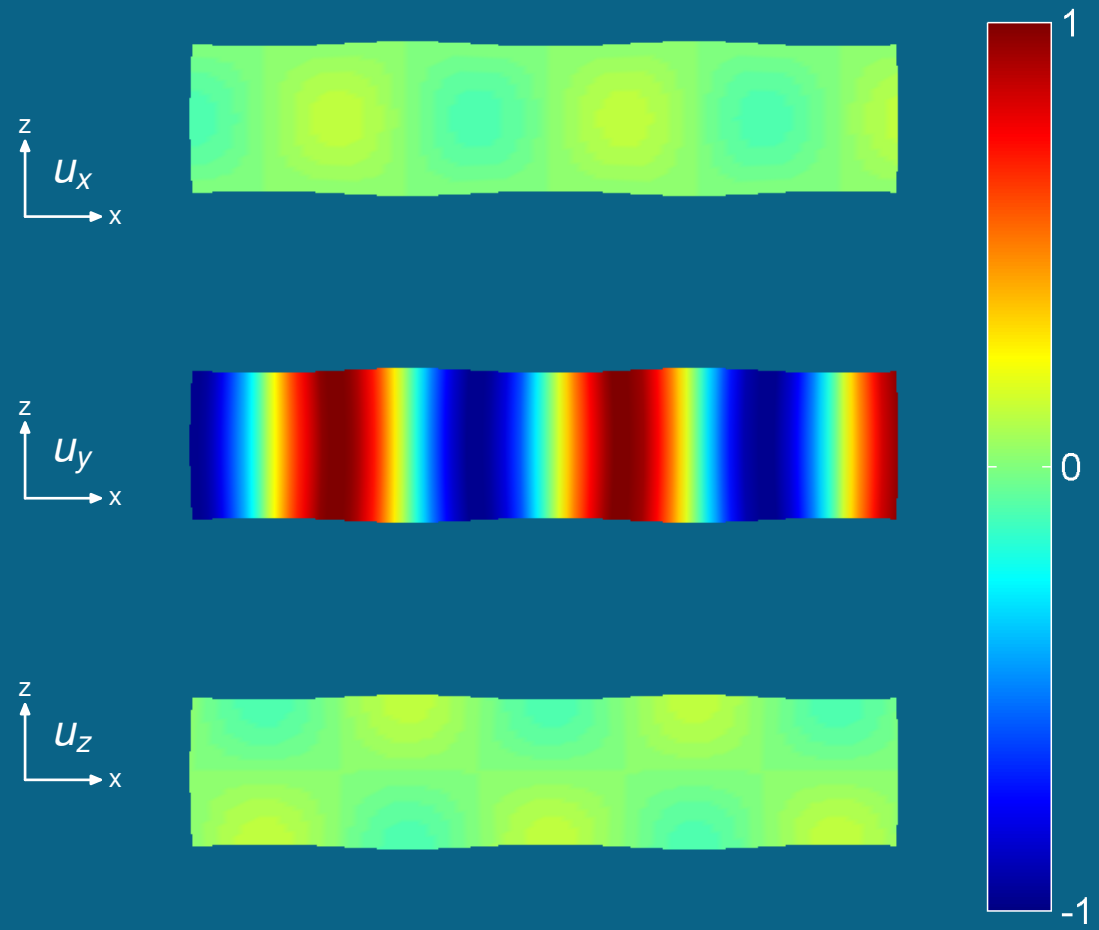
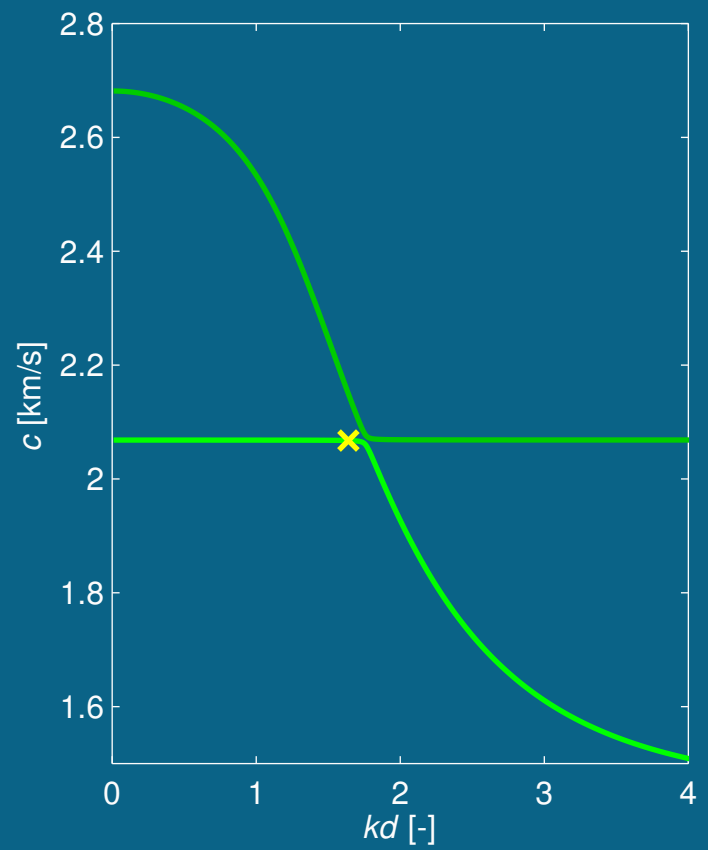
Výchyvky pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.62$



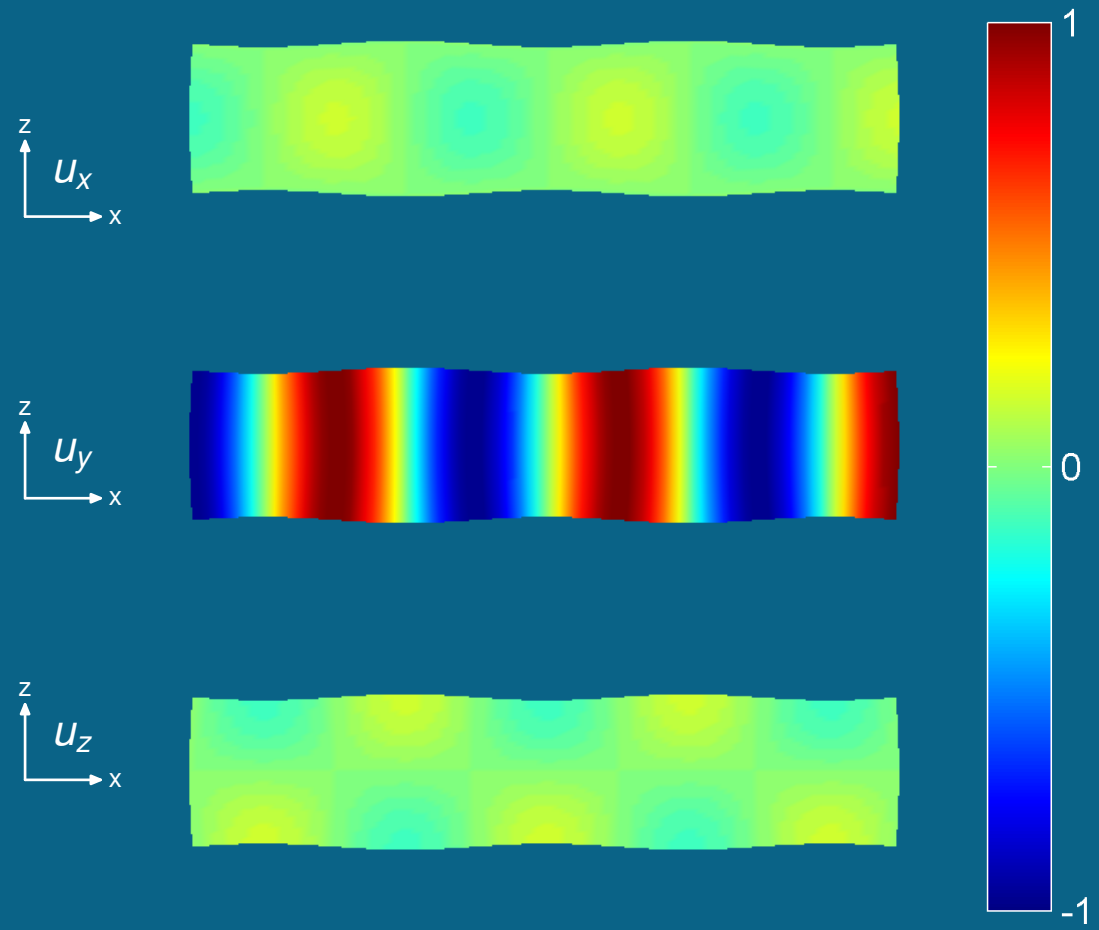
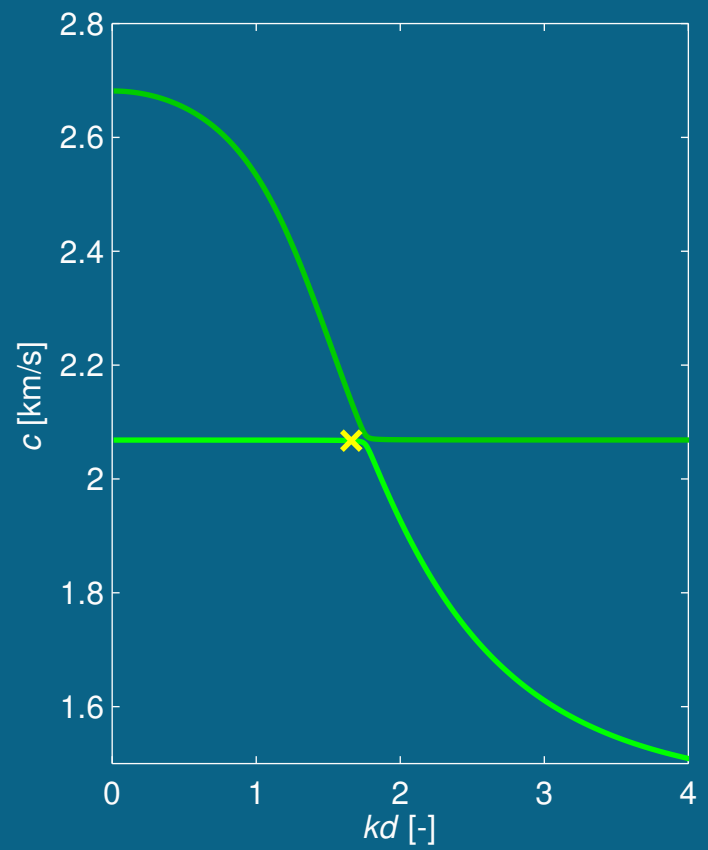
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.64$



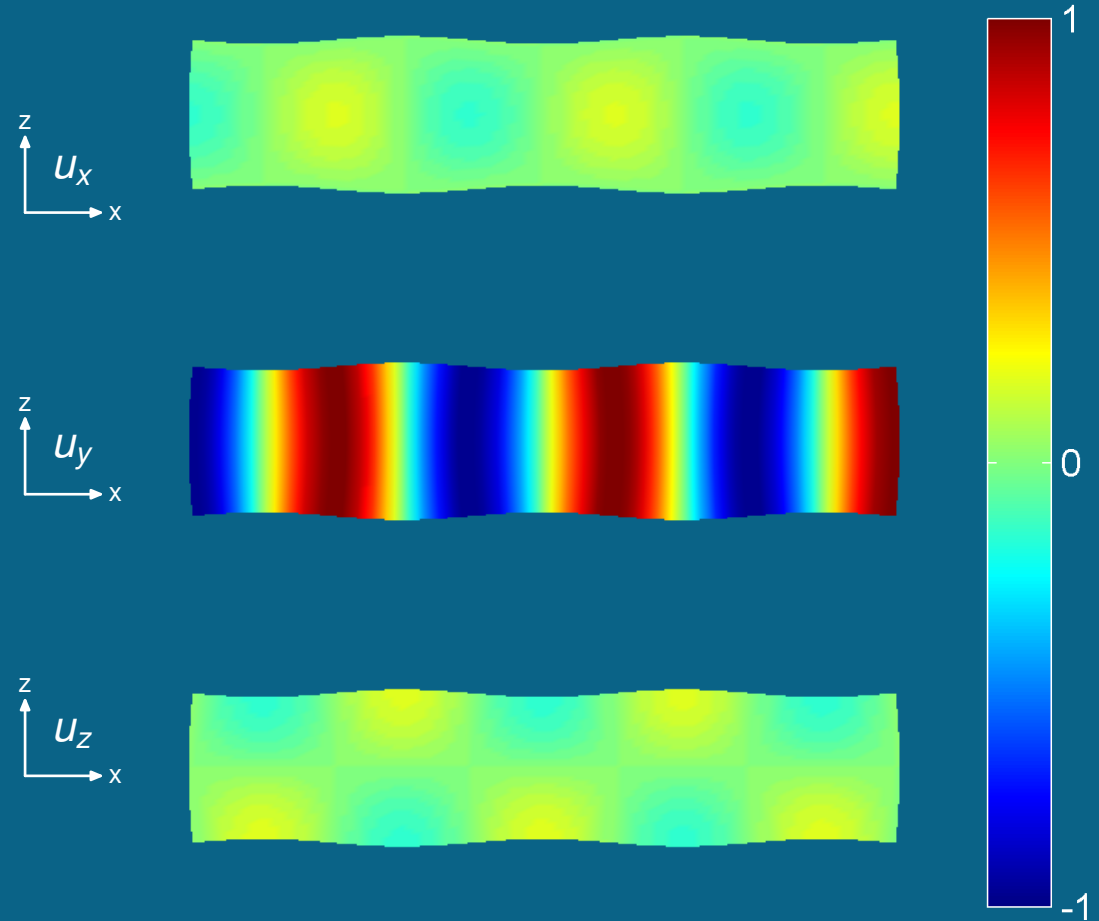
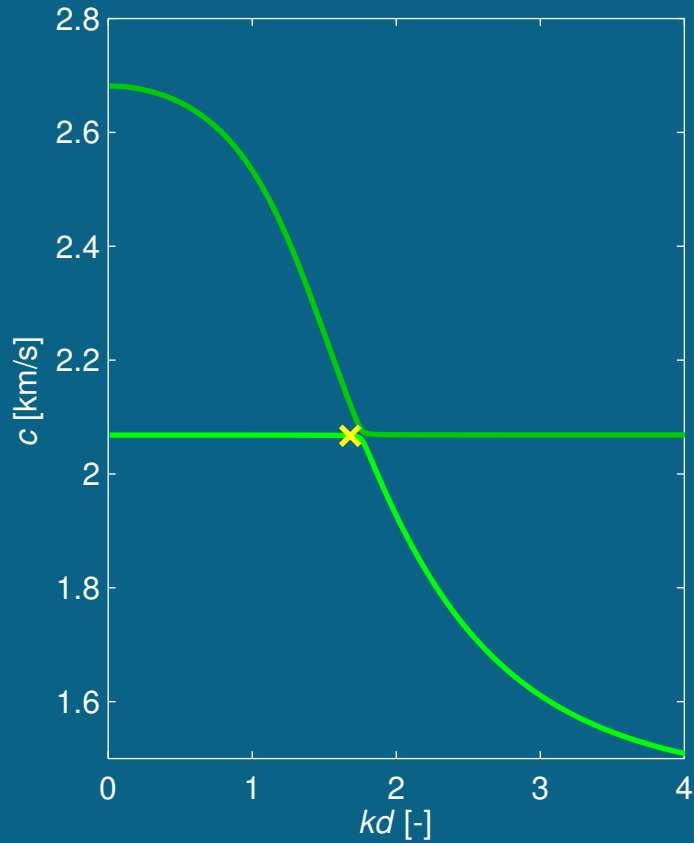
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.66$



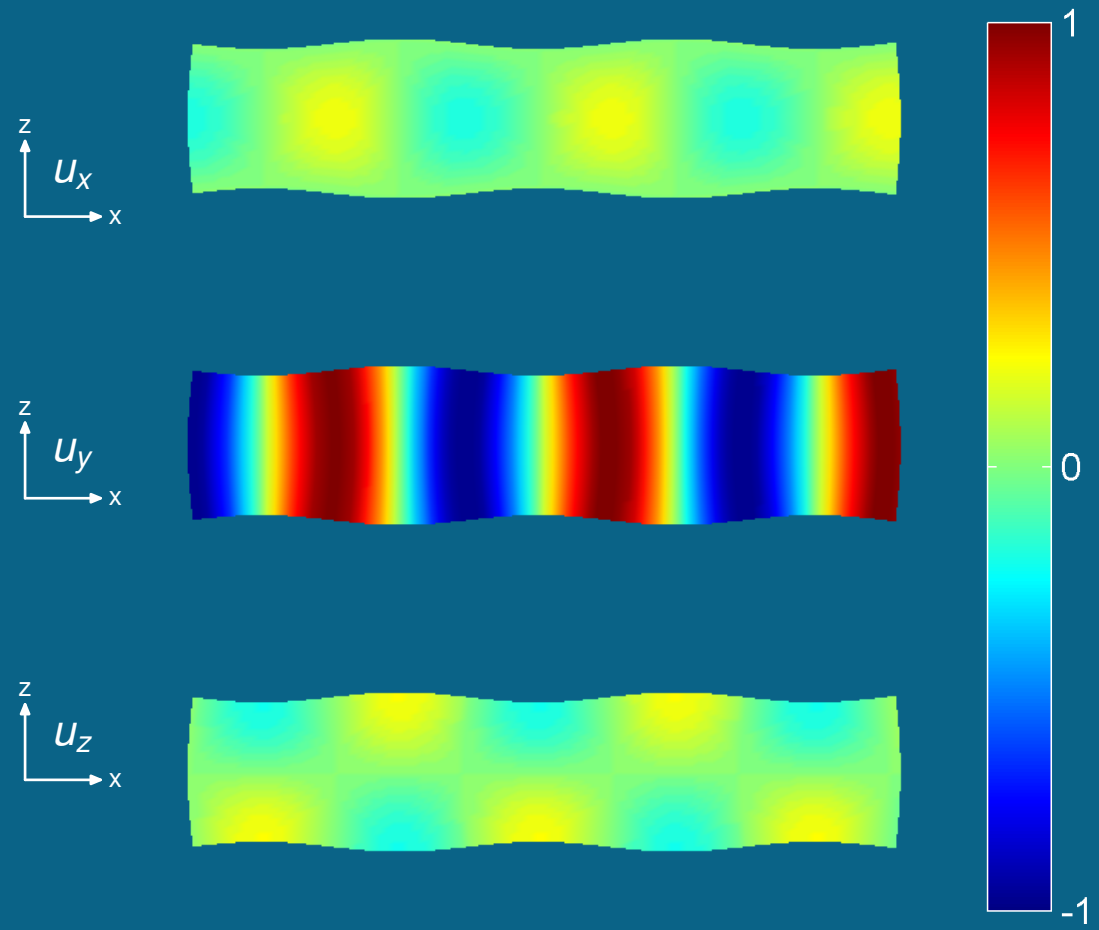
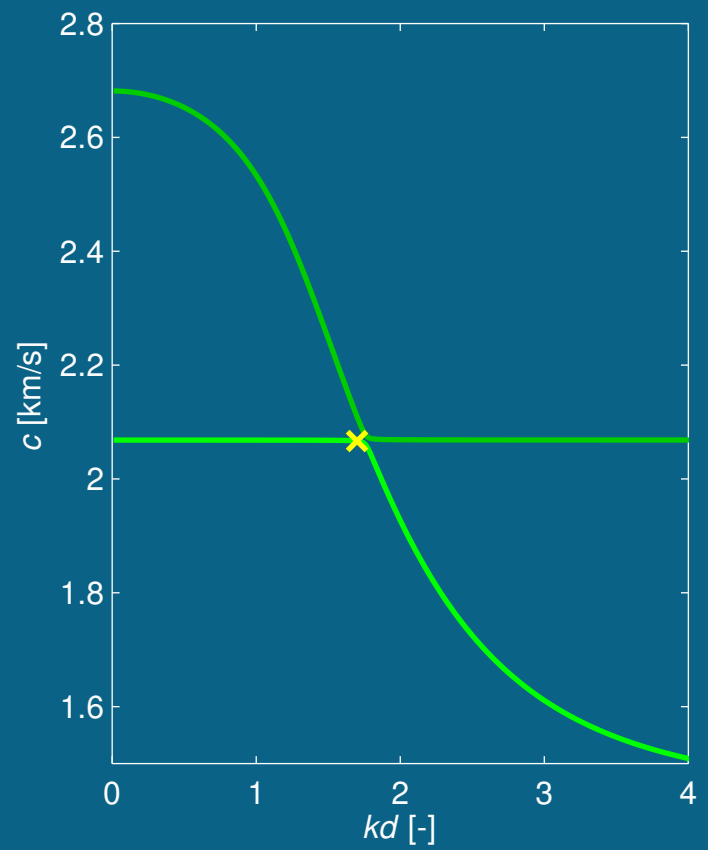
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.68$



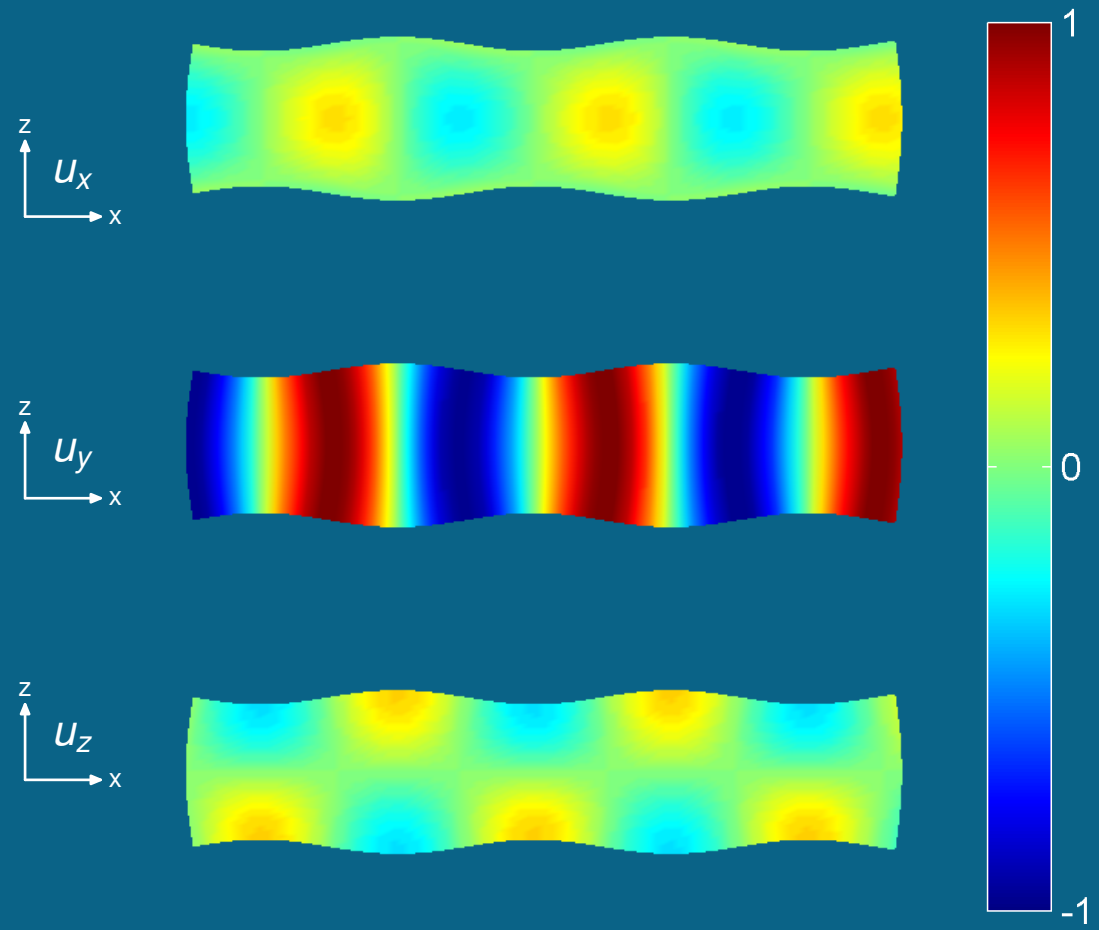
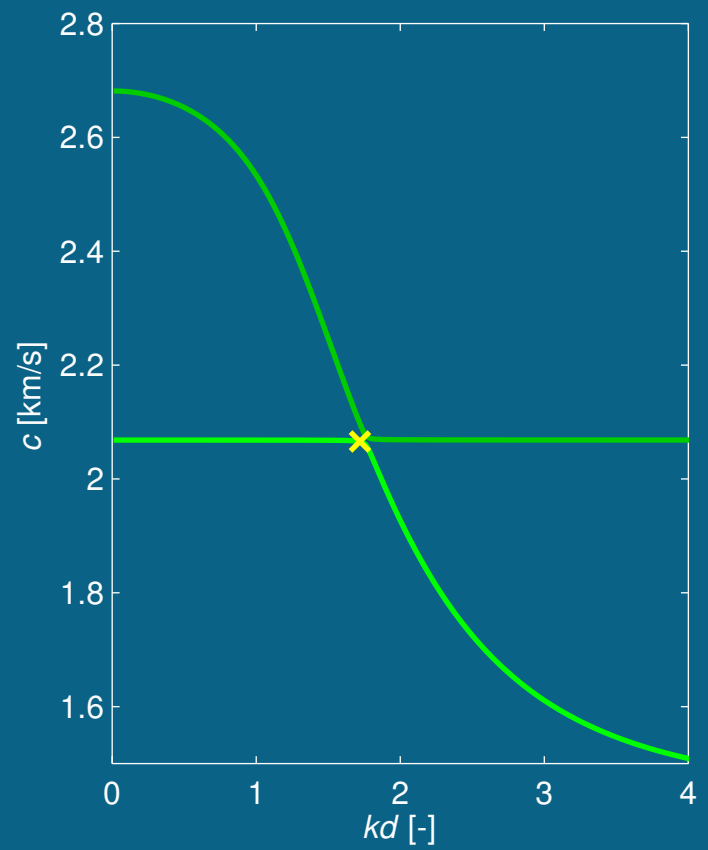
Výchyvky pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.70$



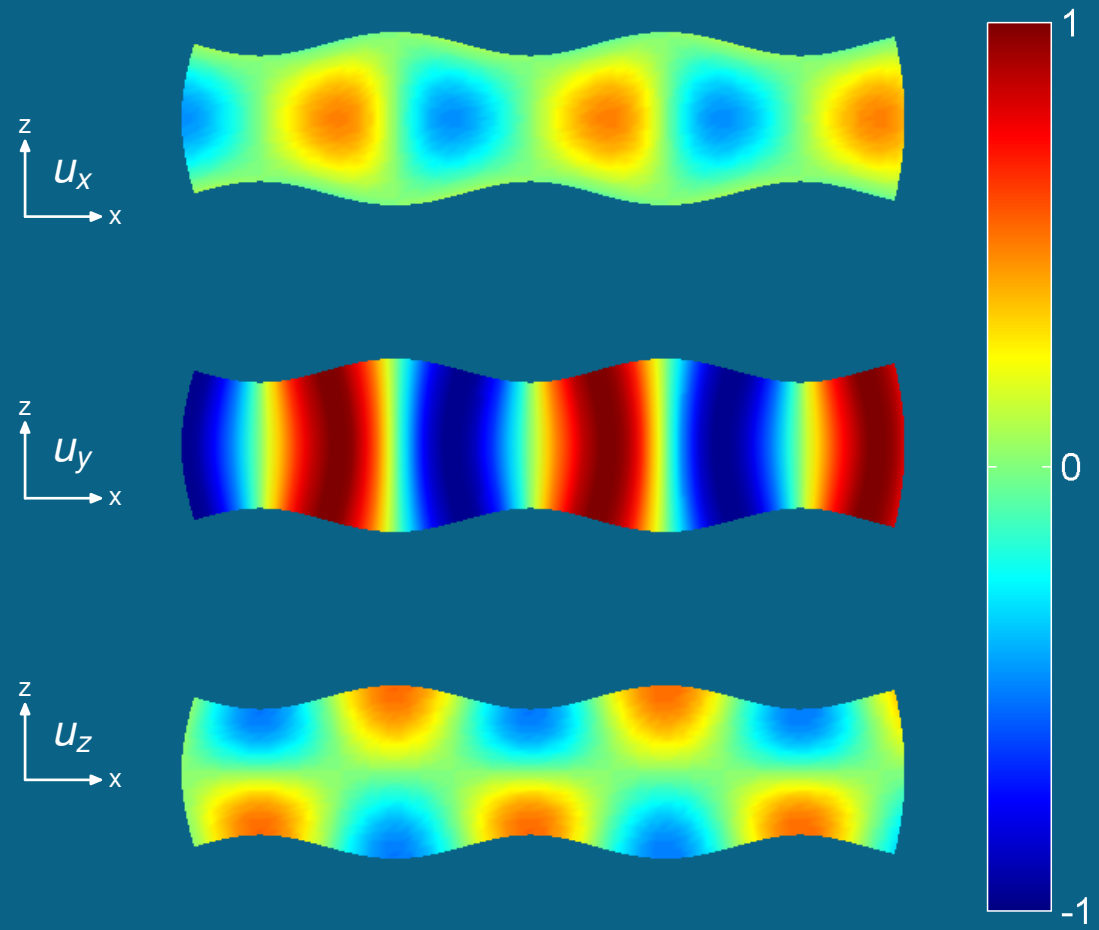
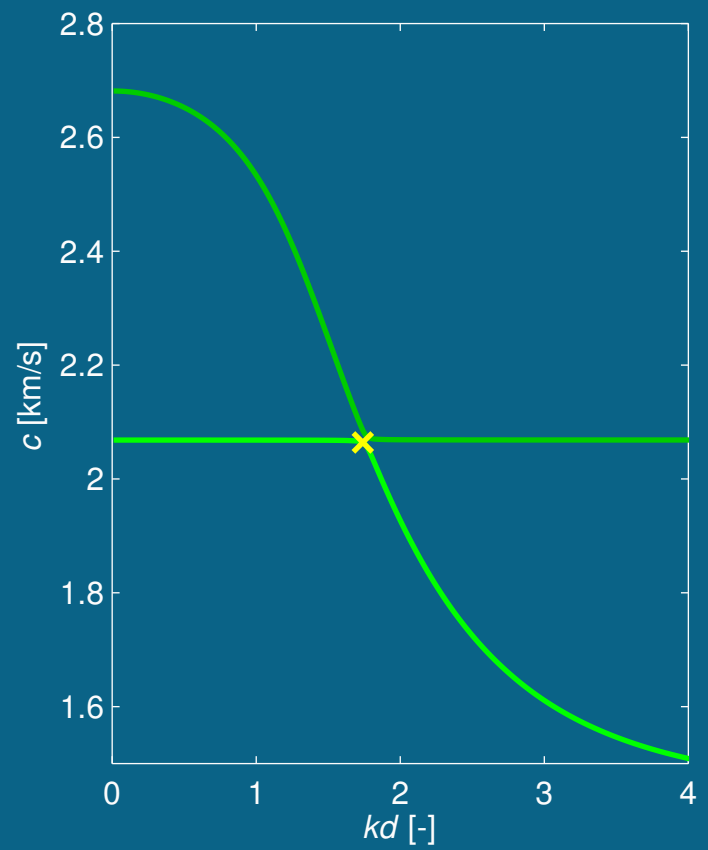
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.72$



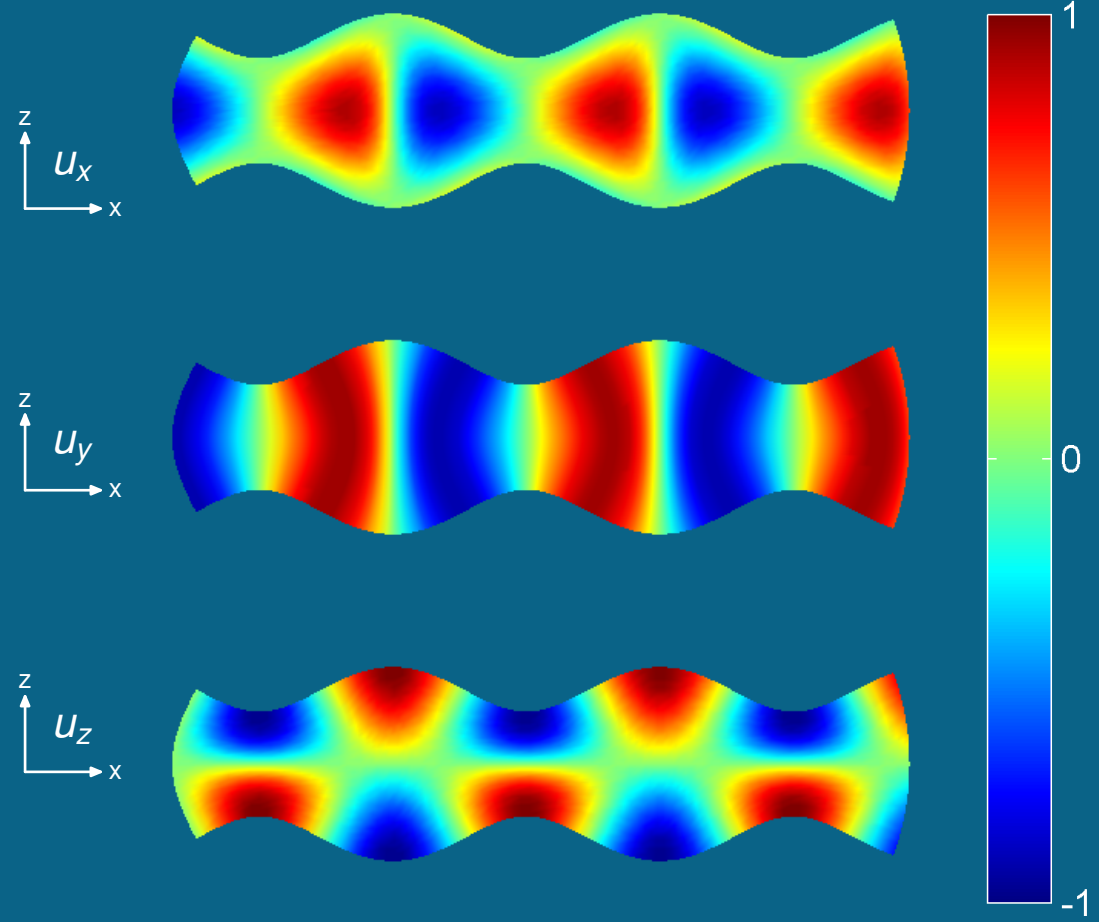
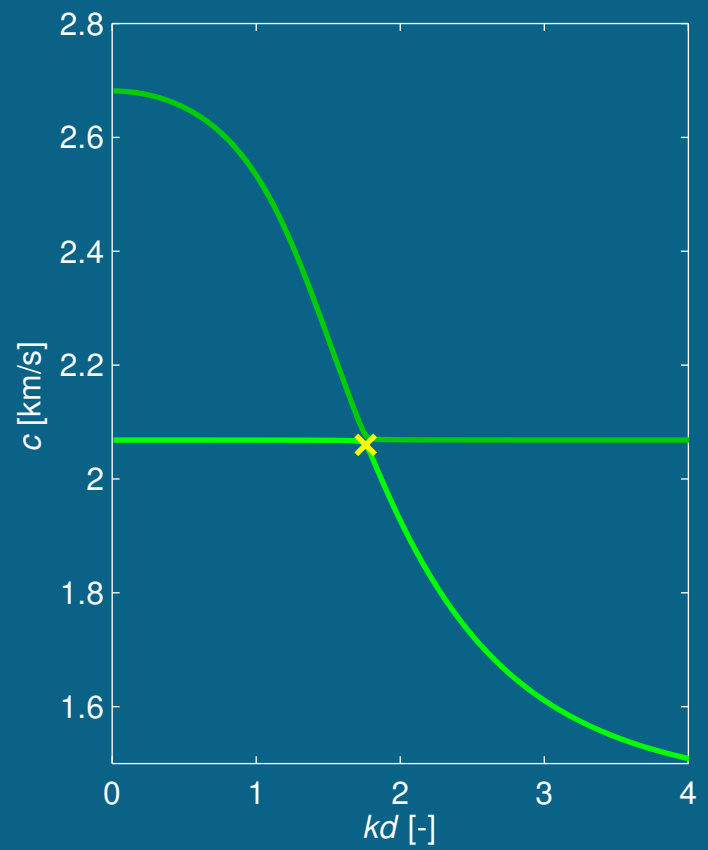
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.74$



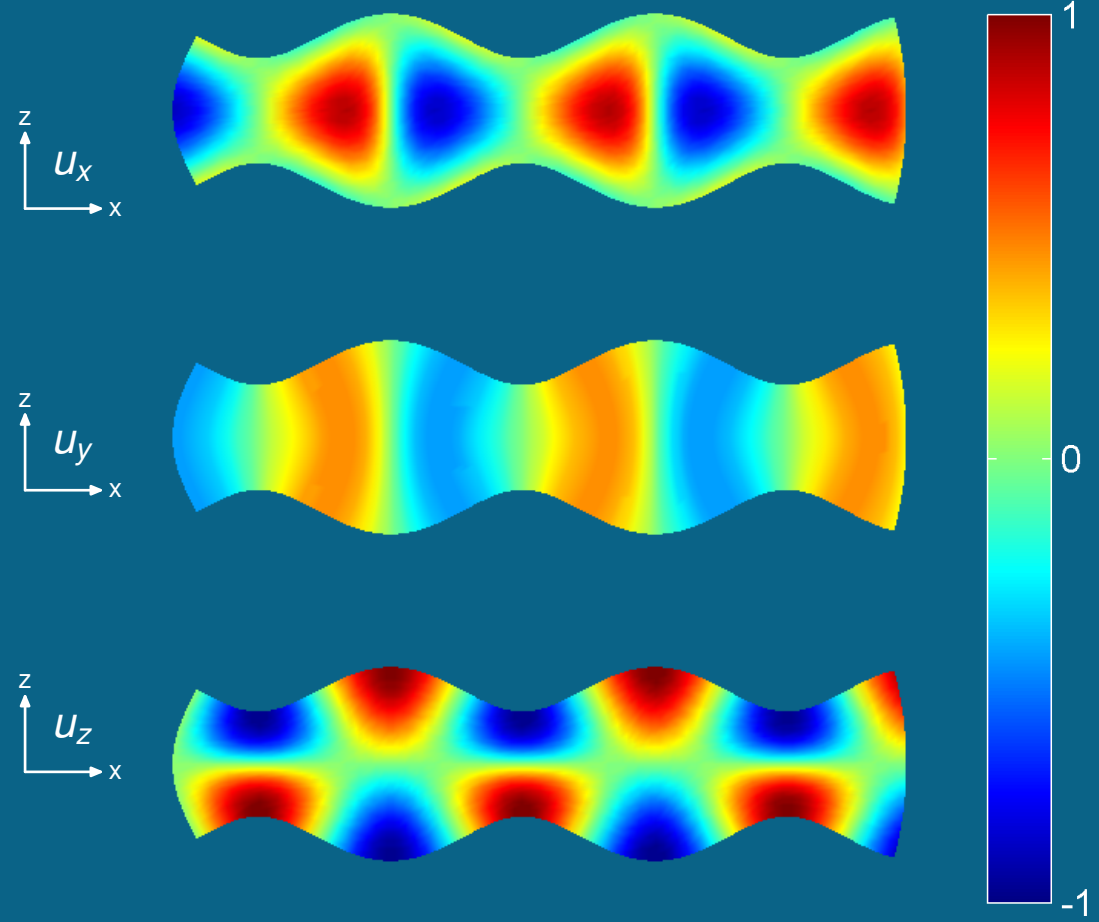
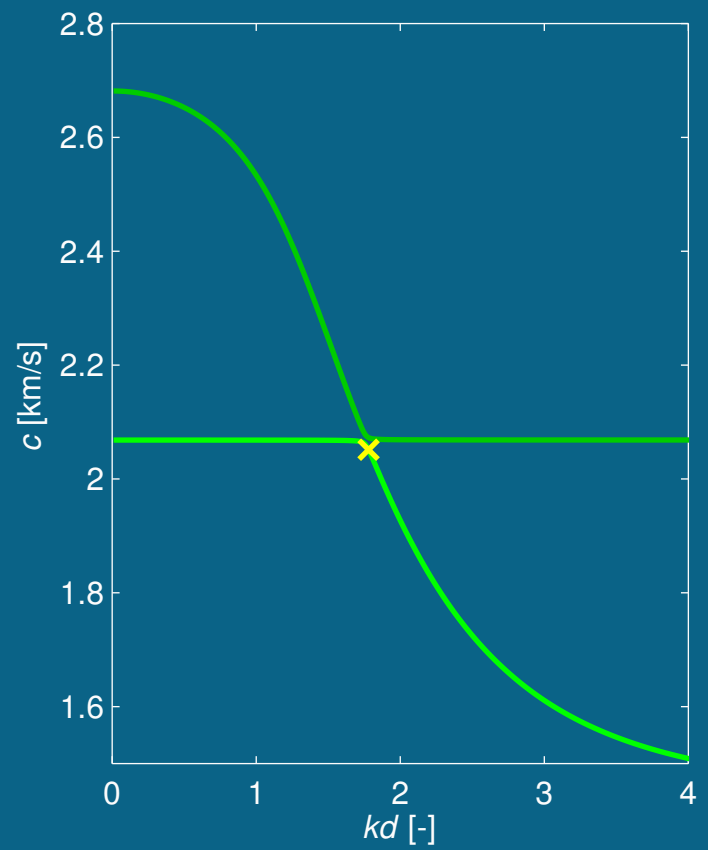
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.76$



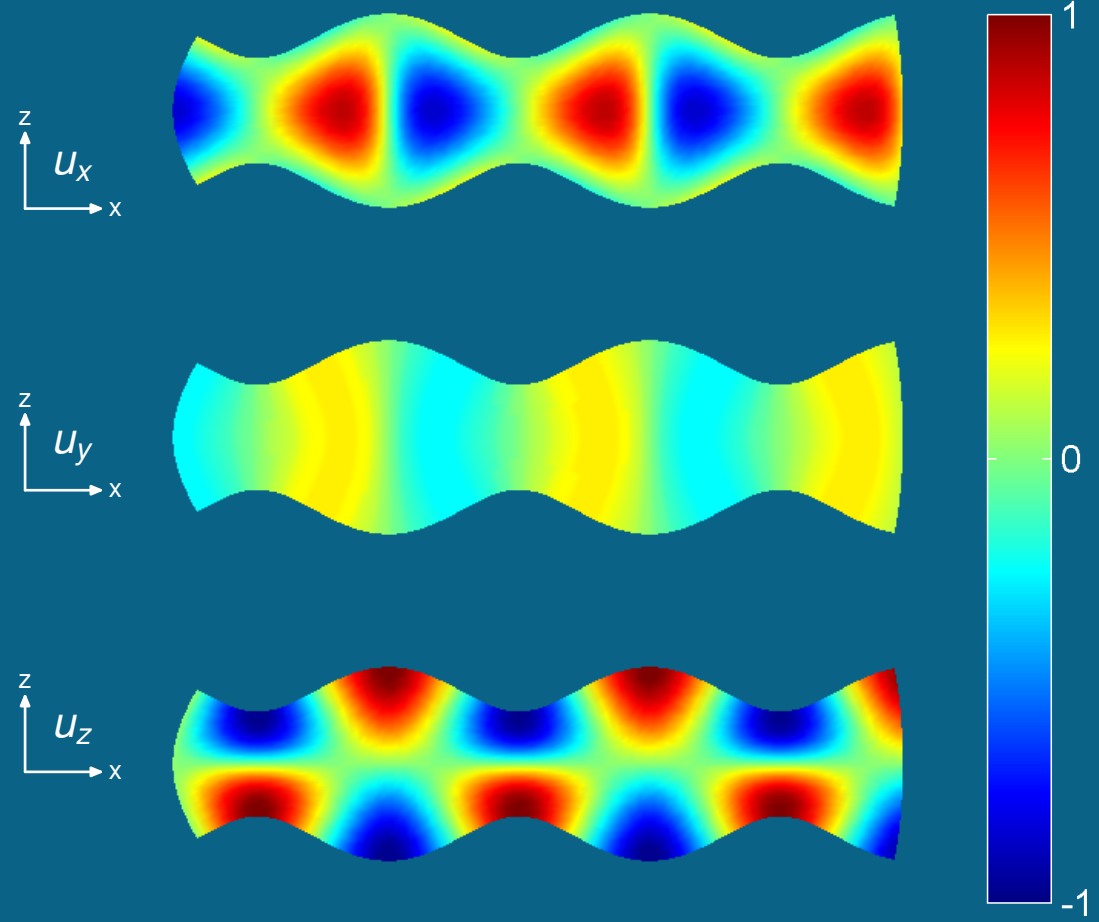
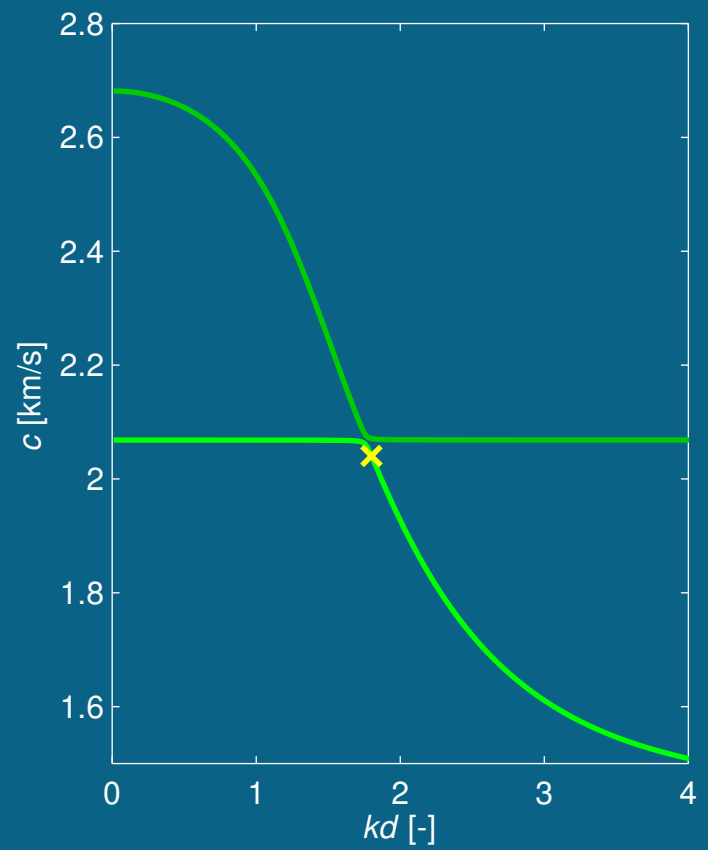
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.78$



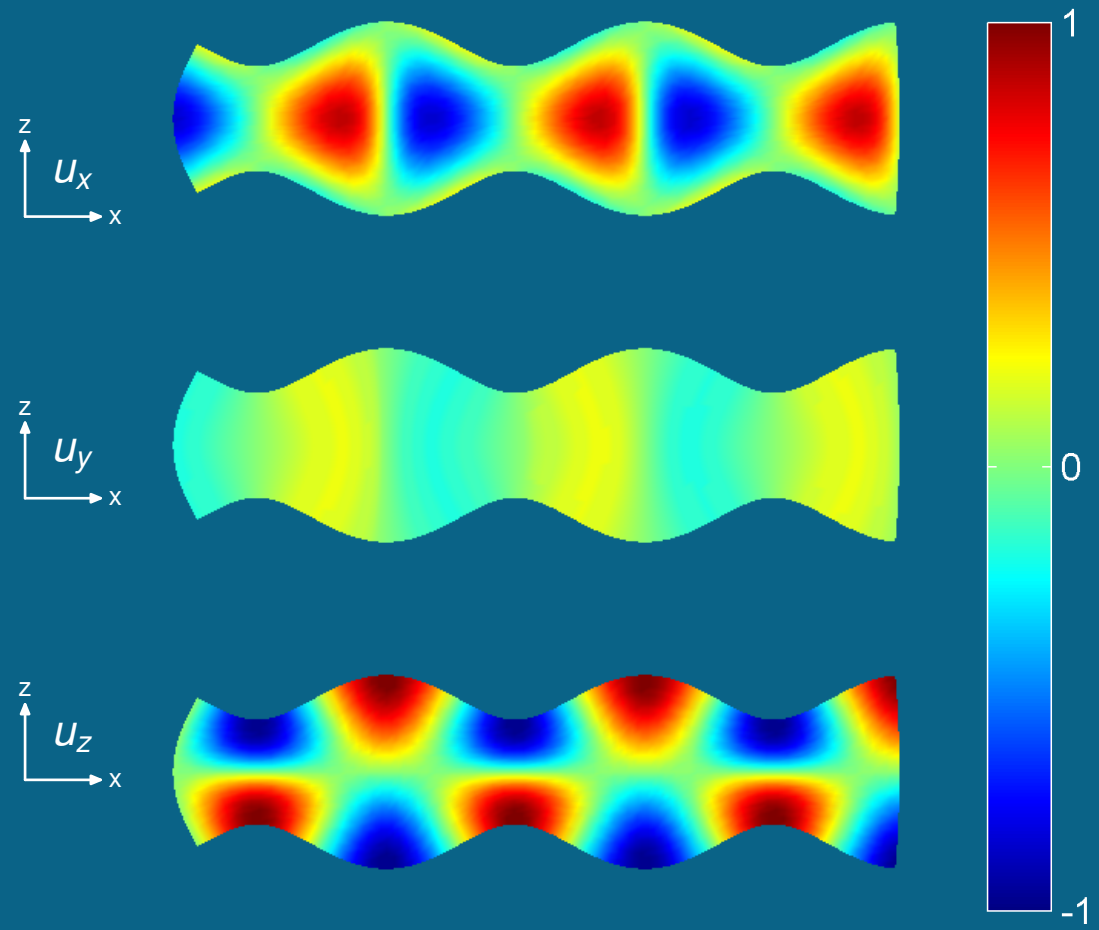
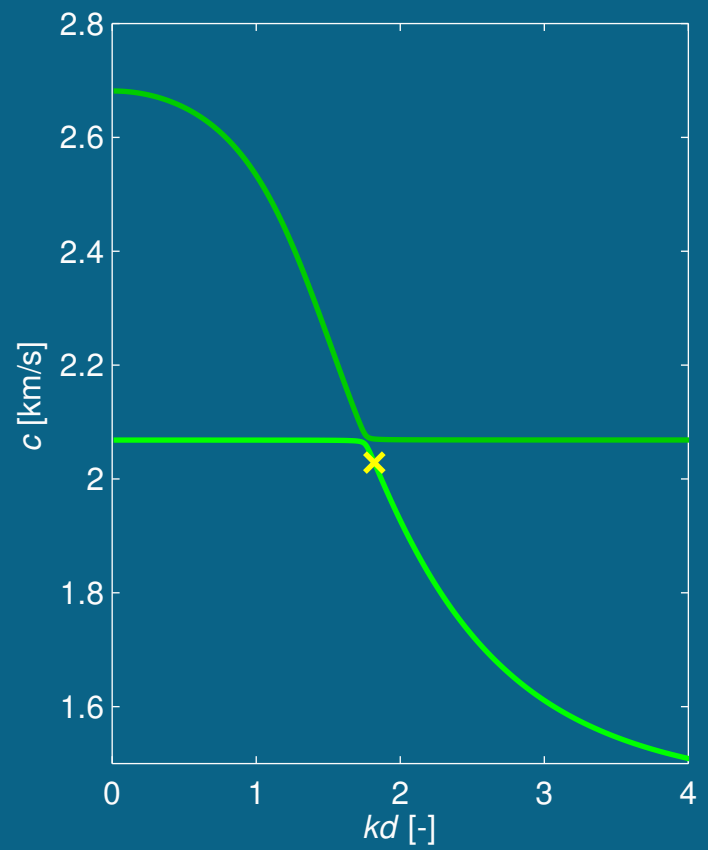
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.80$



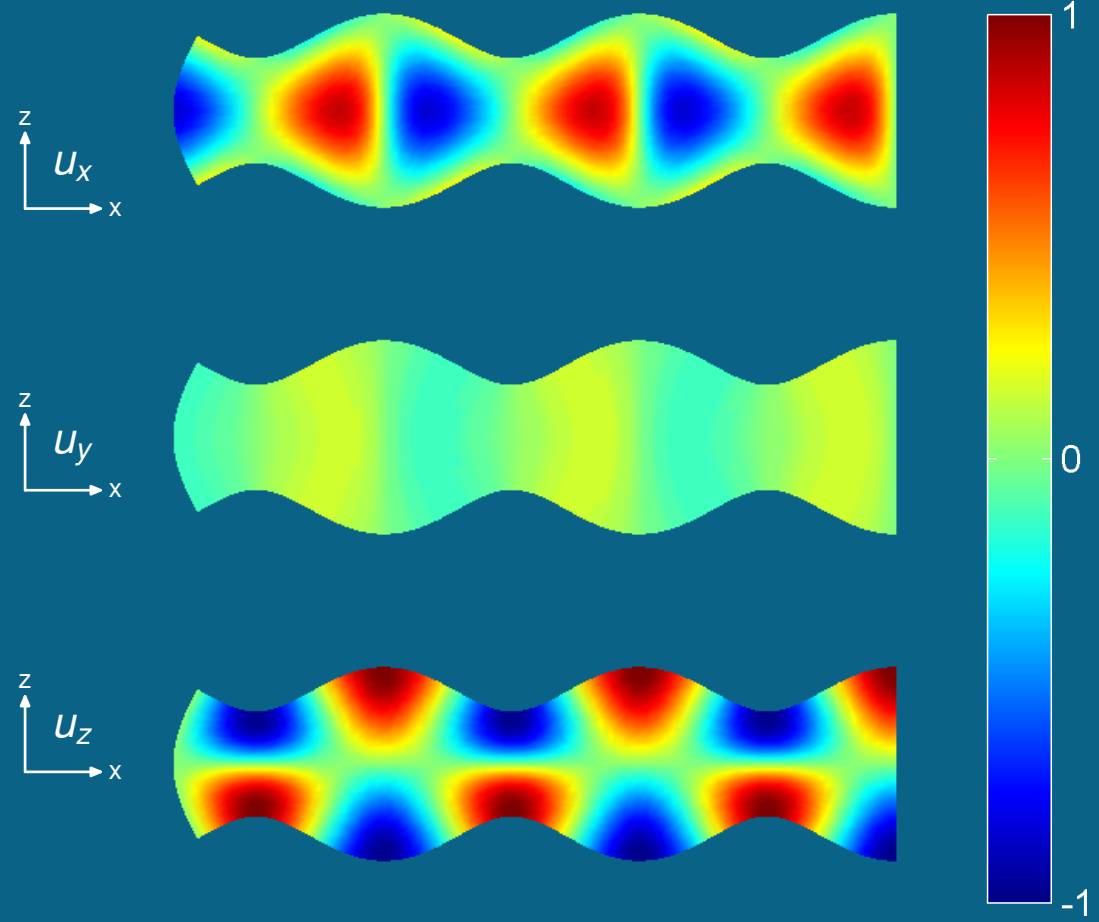
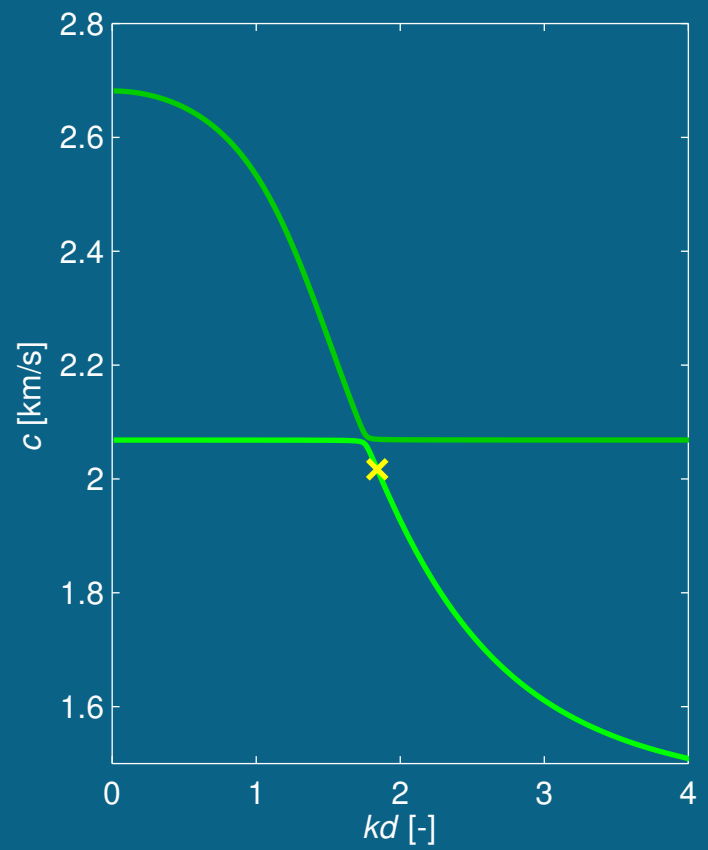
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.82$



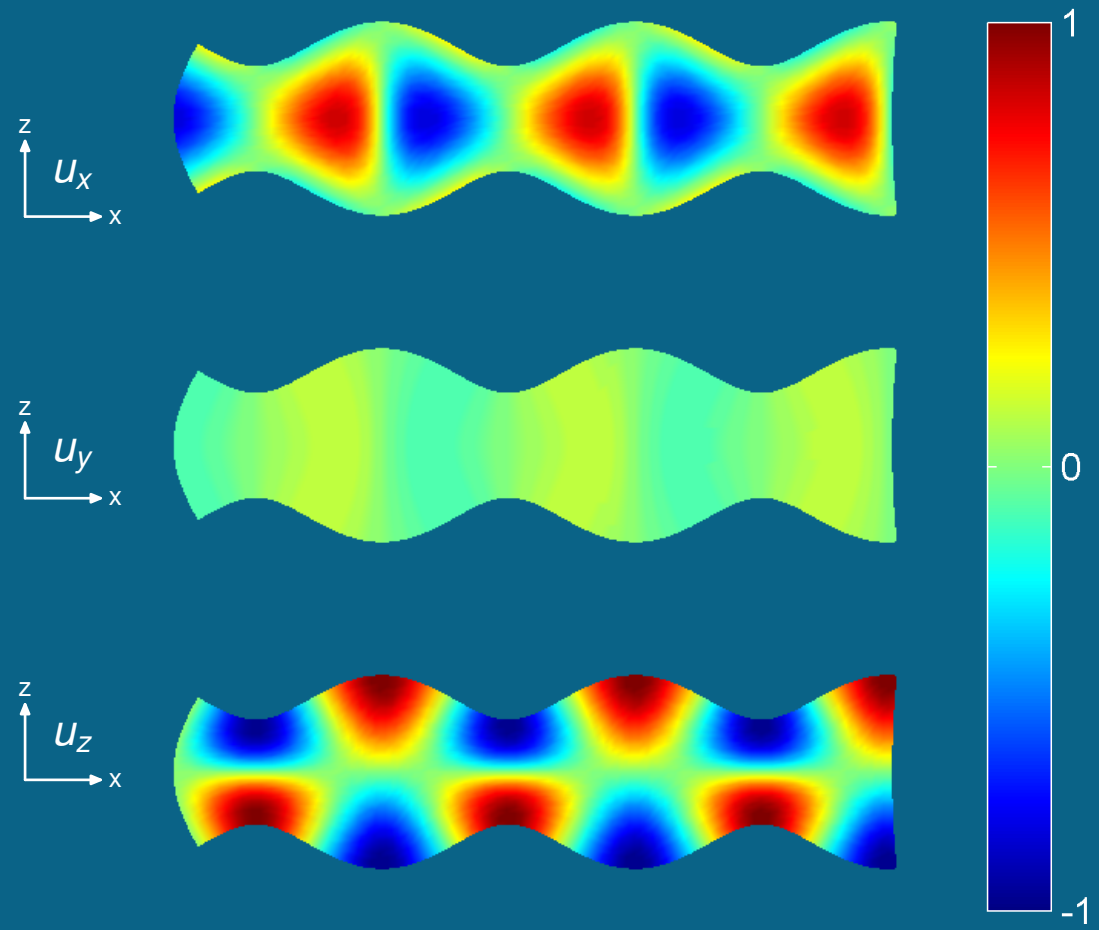
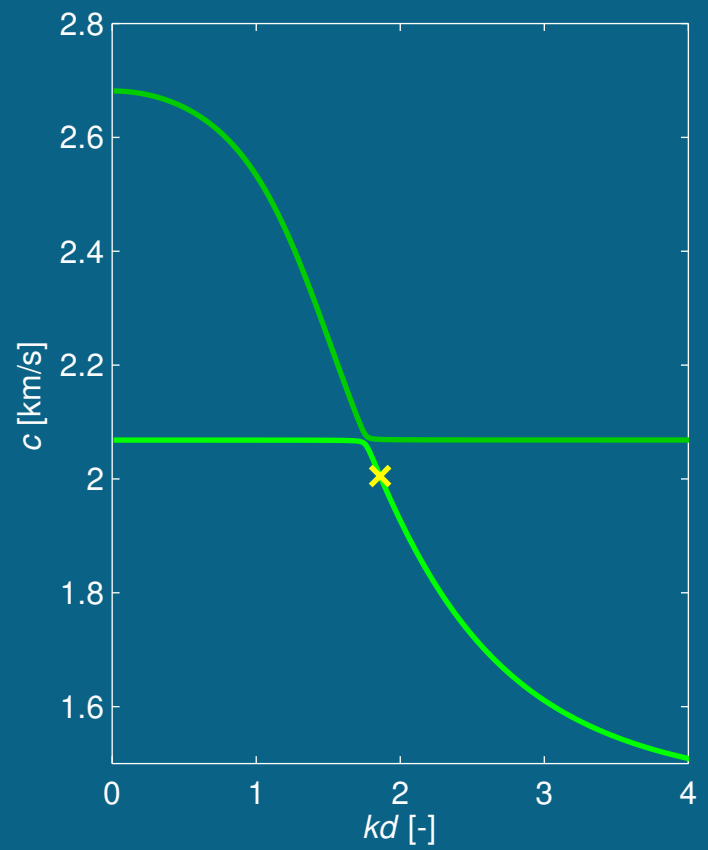
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.84$



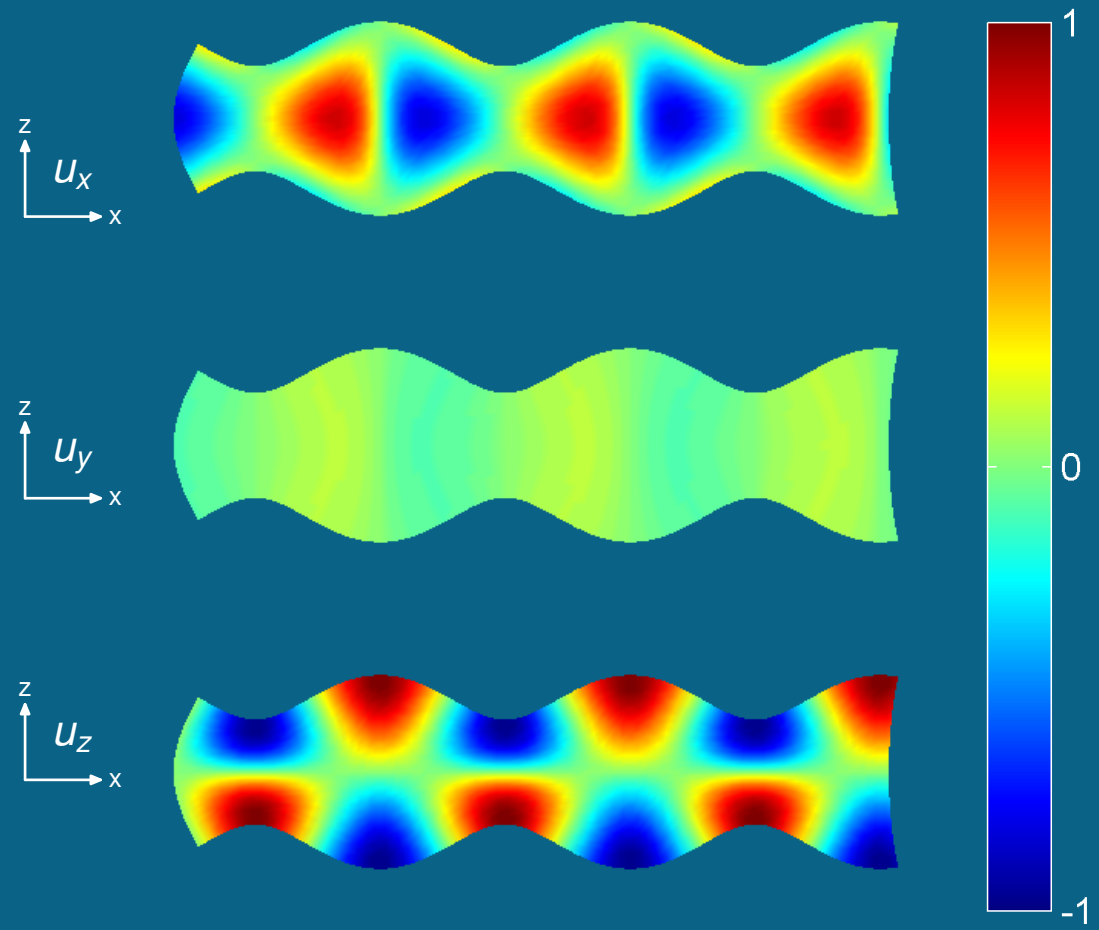
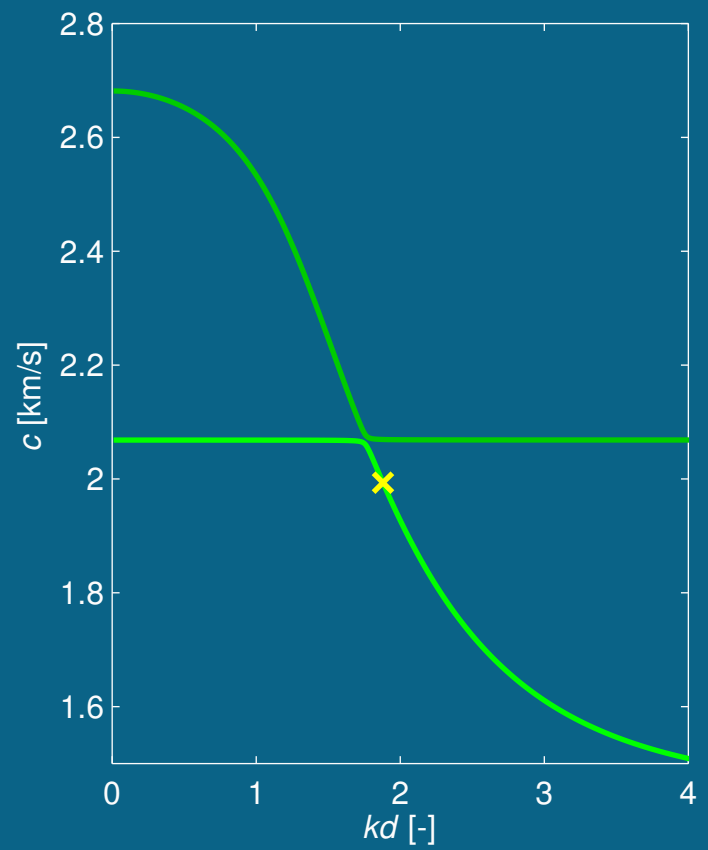
Výchyvky pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.86$



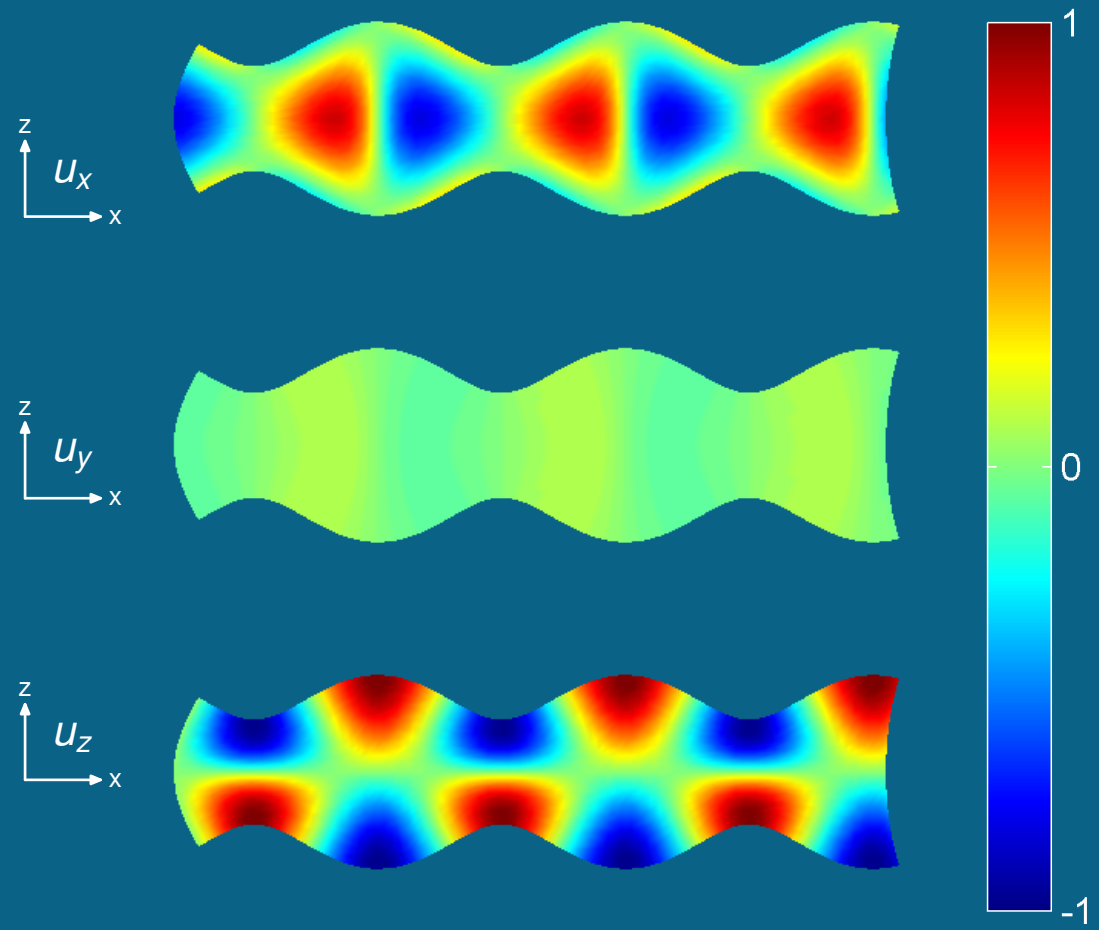
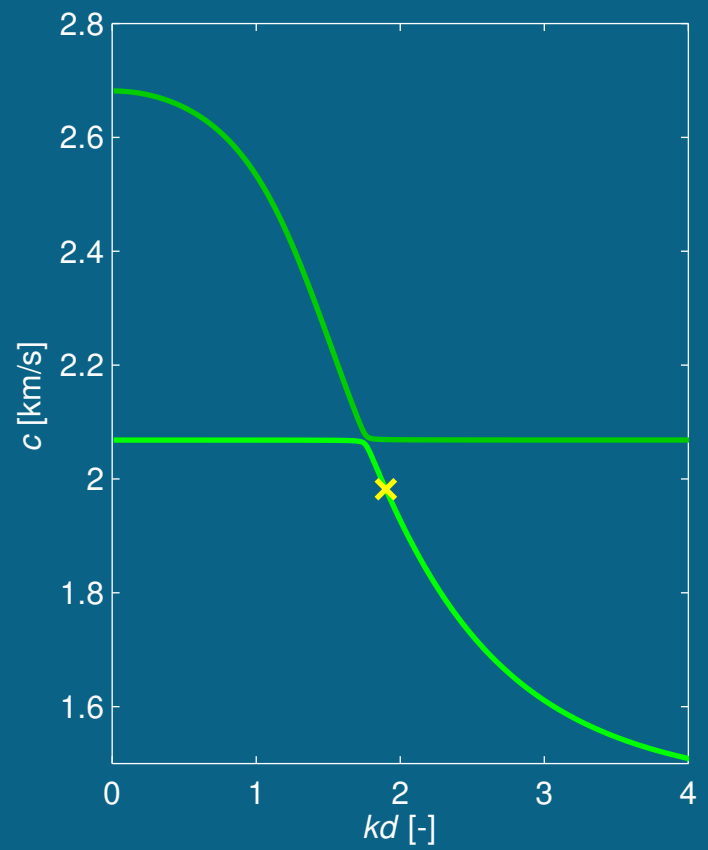
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.88$



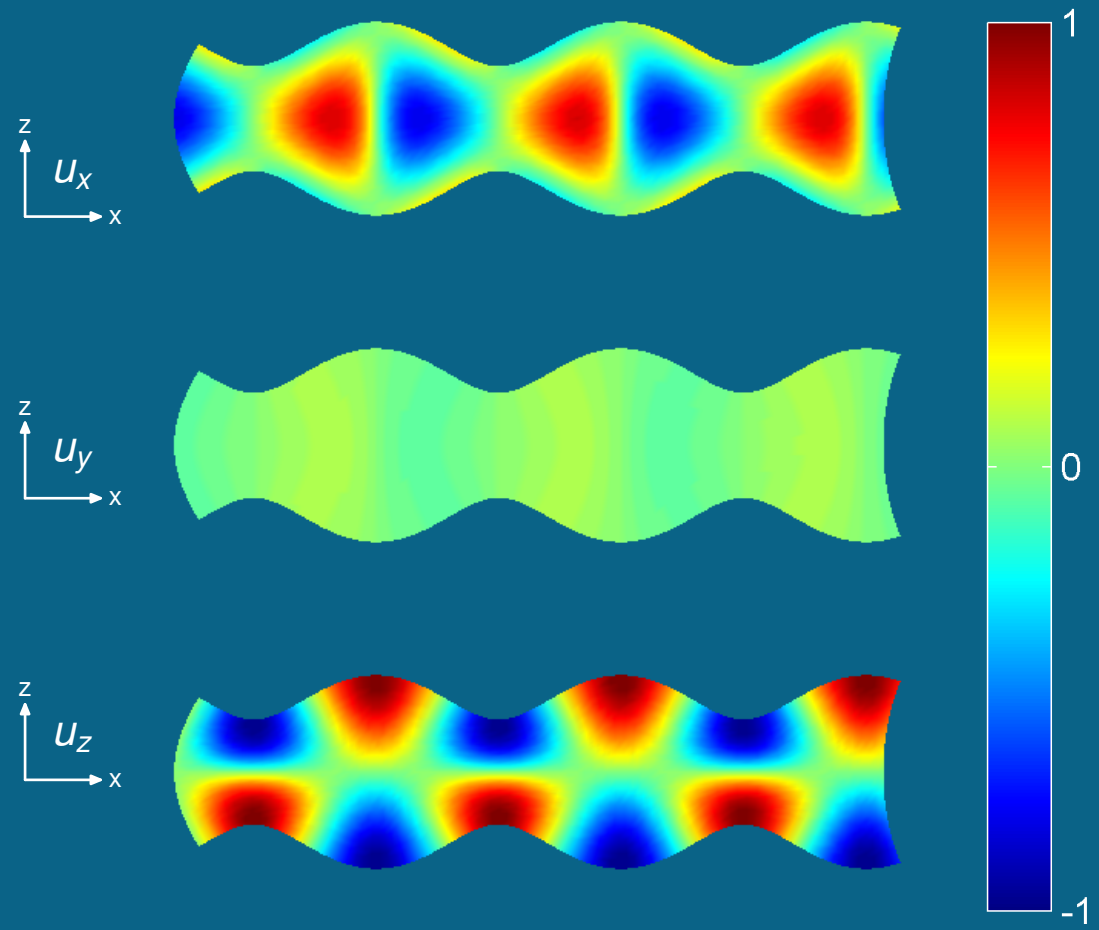
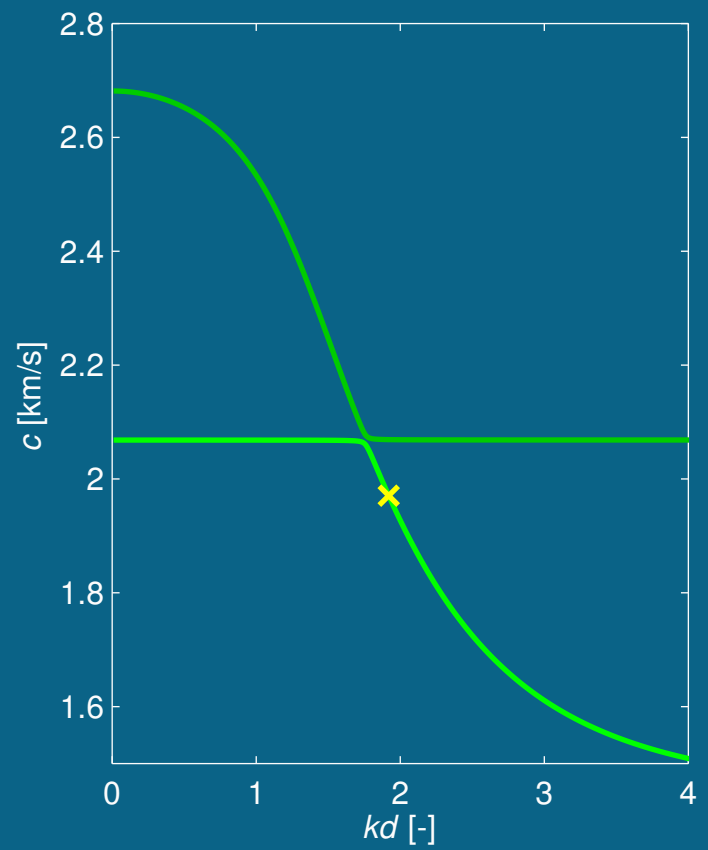
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.90$



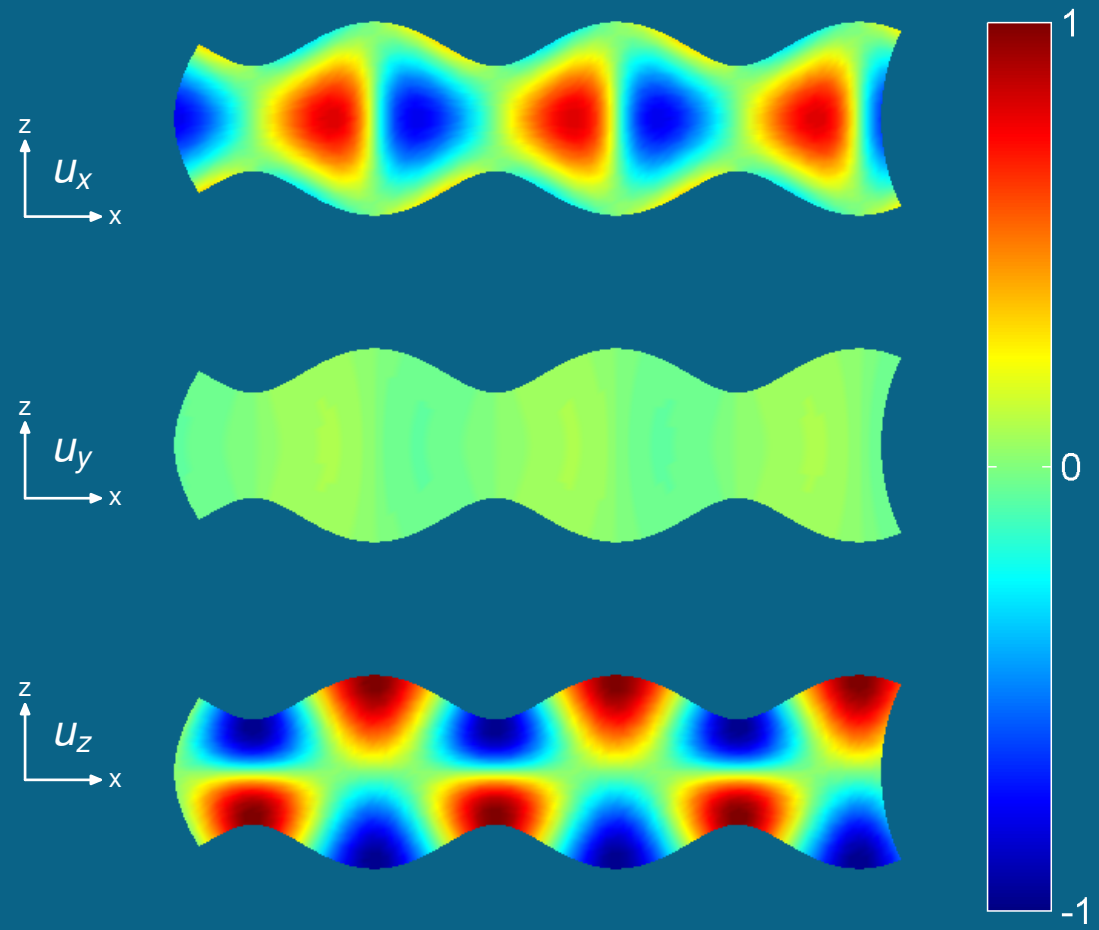
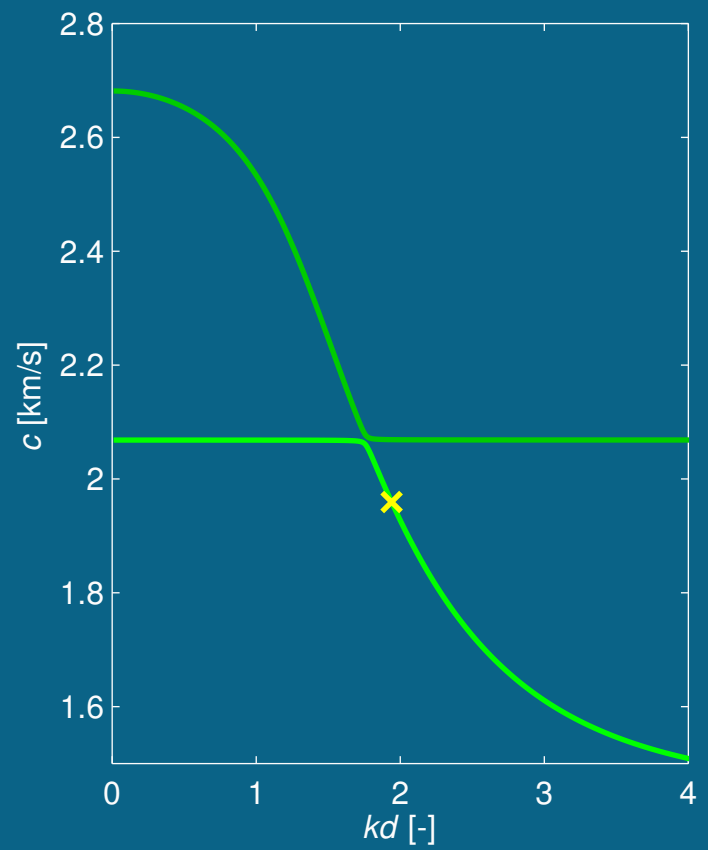
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.92$



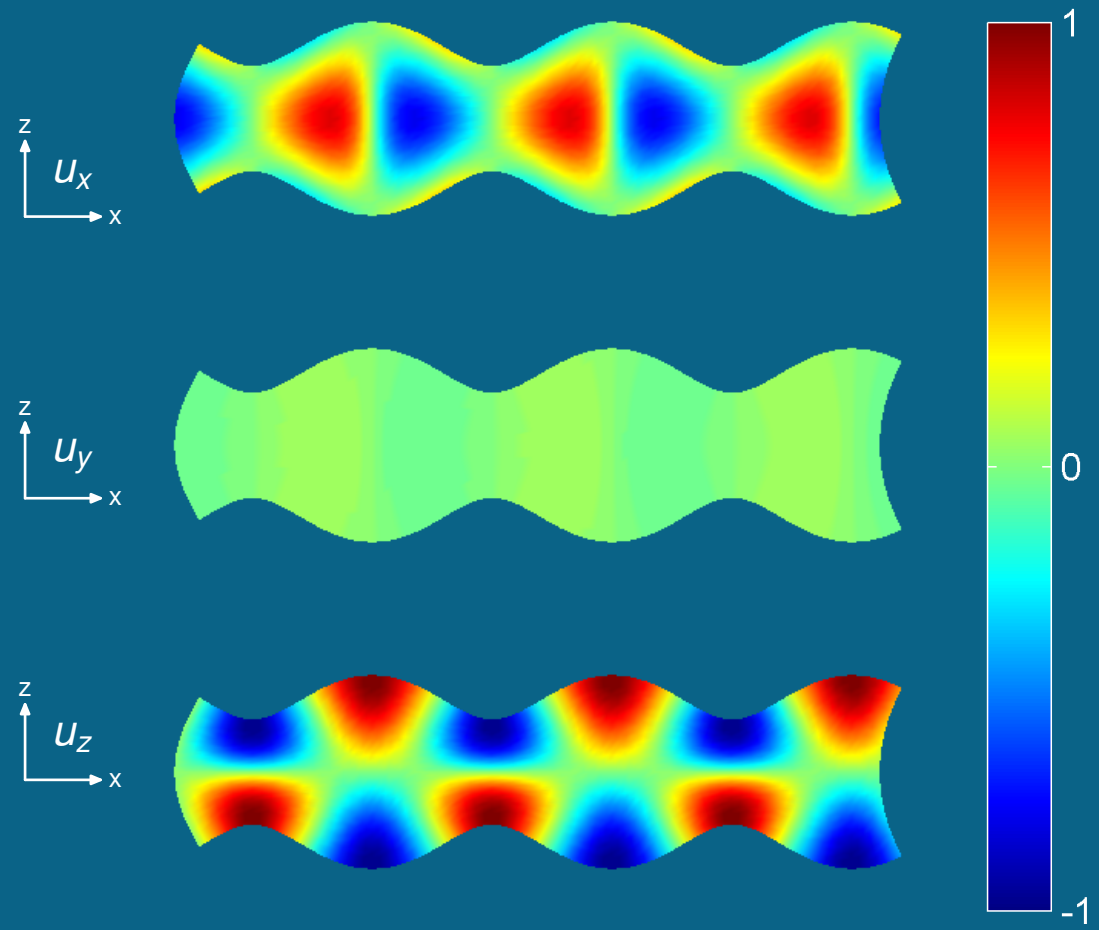
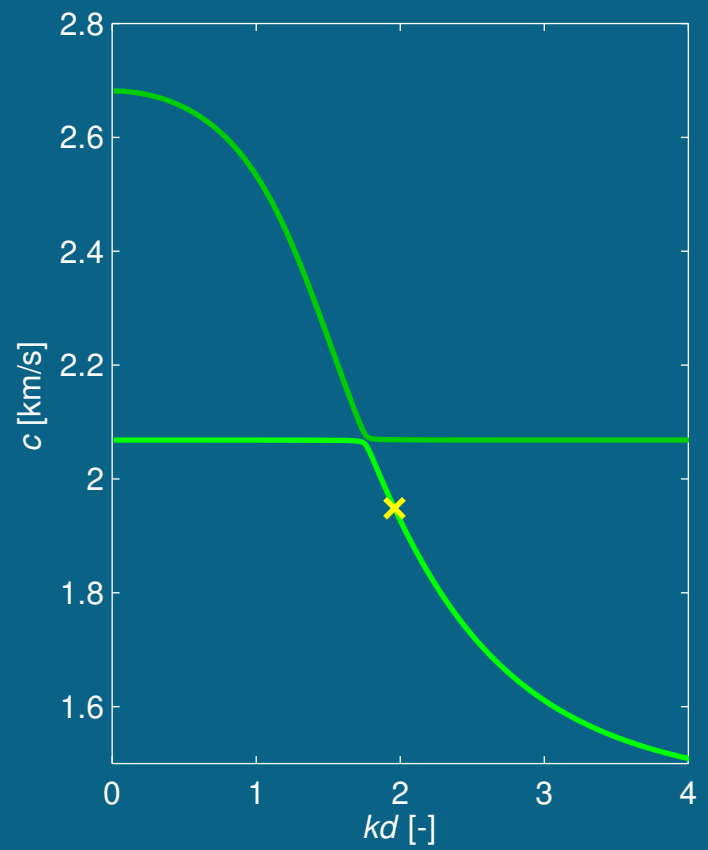
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.94$



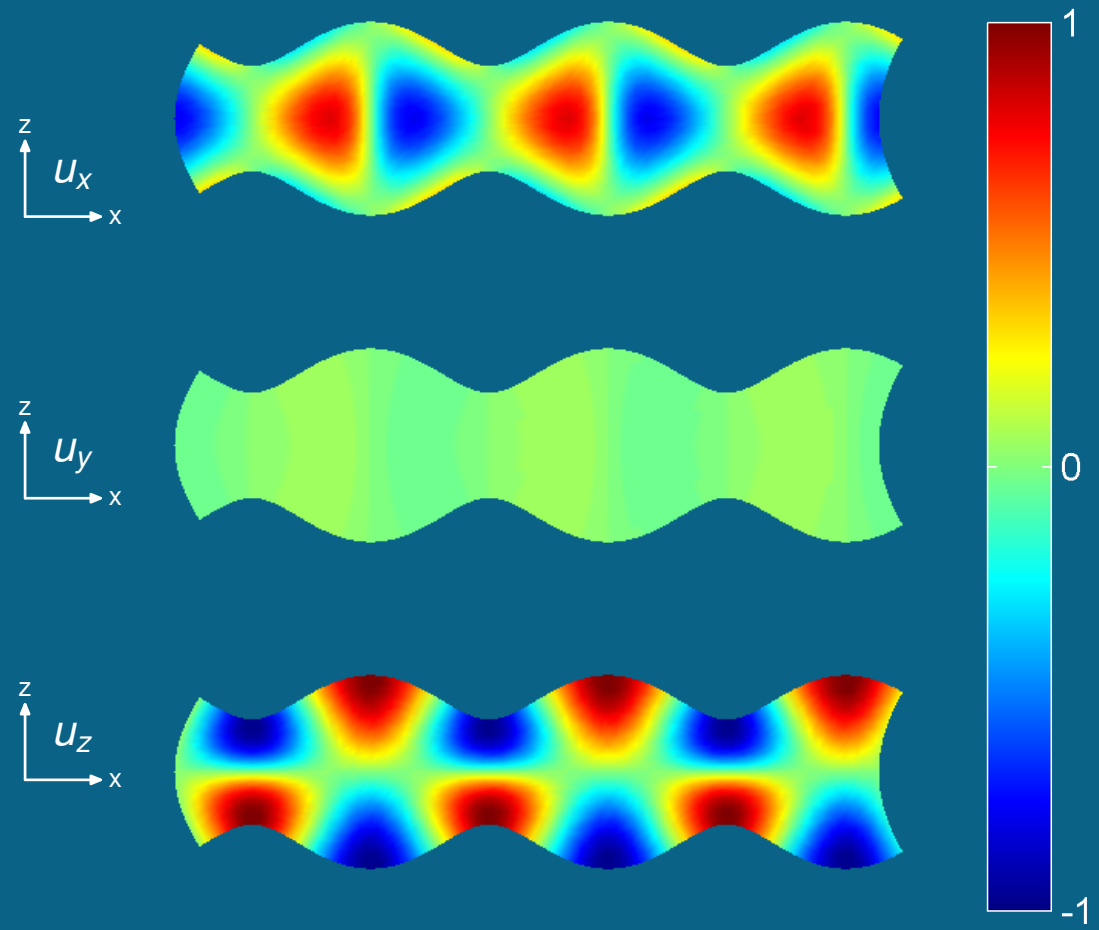
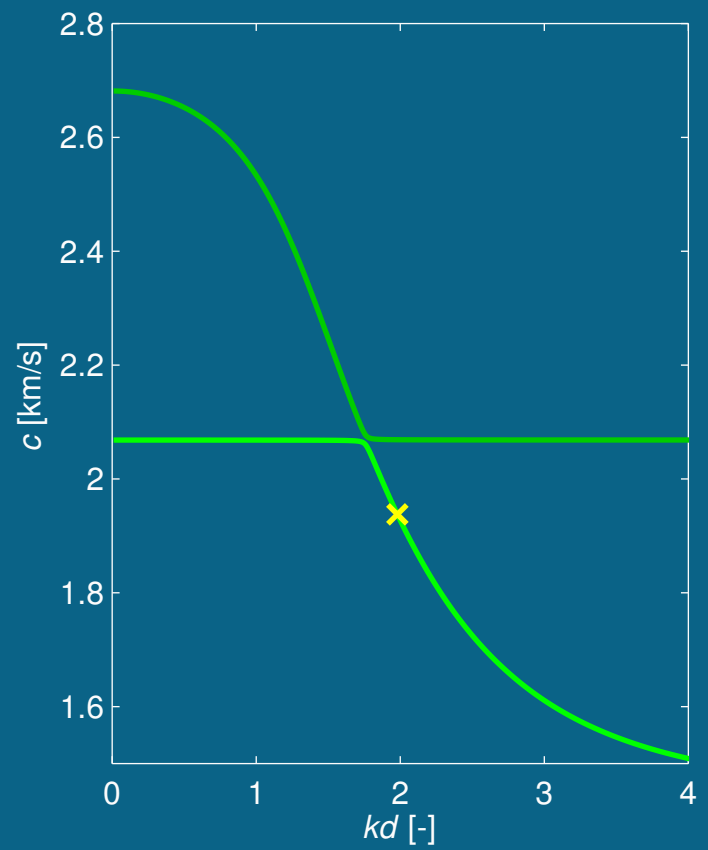
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.96$



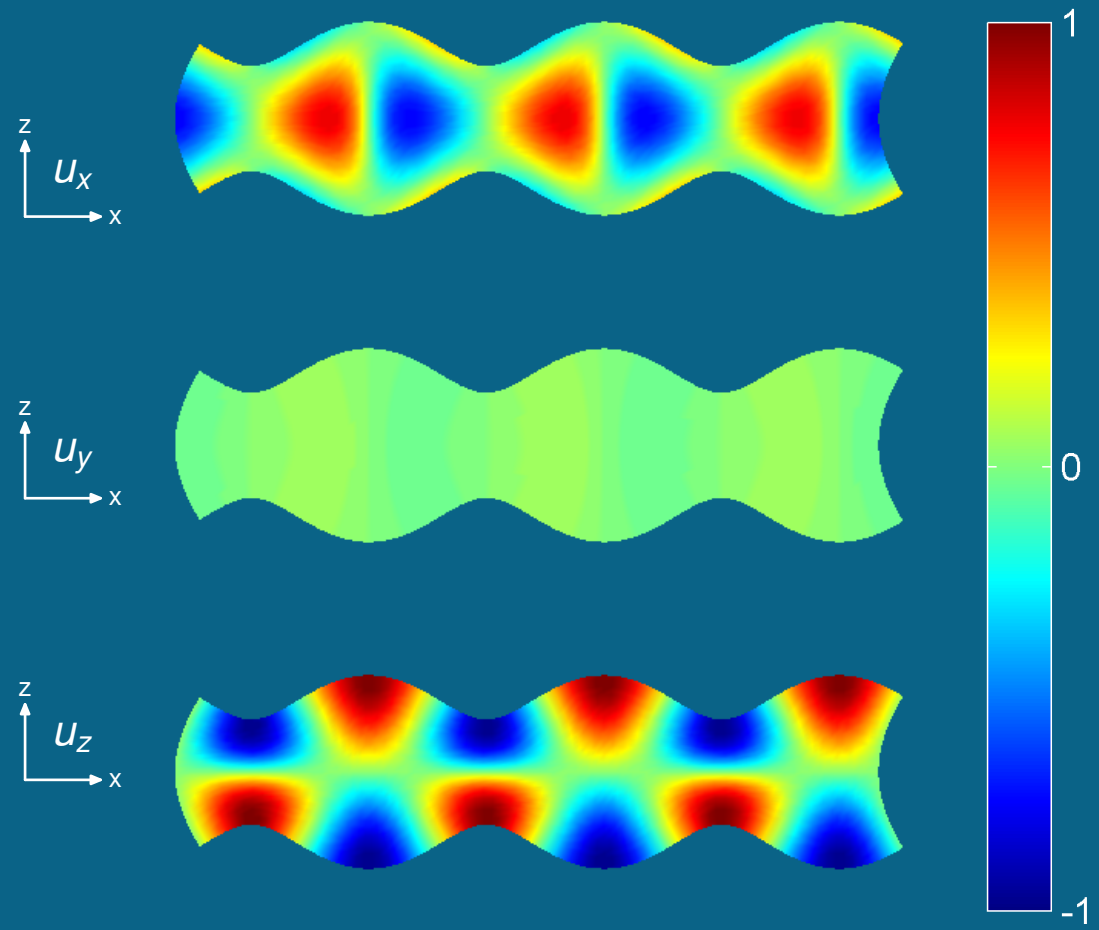
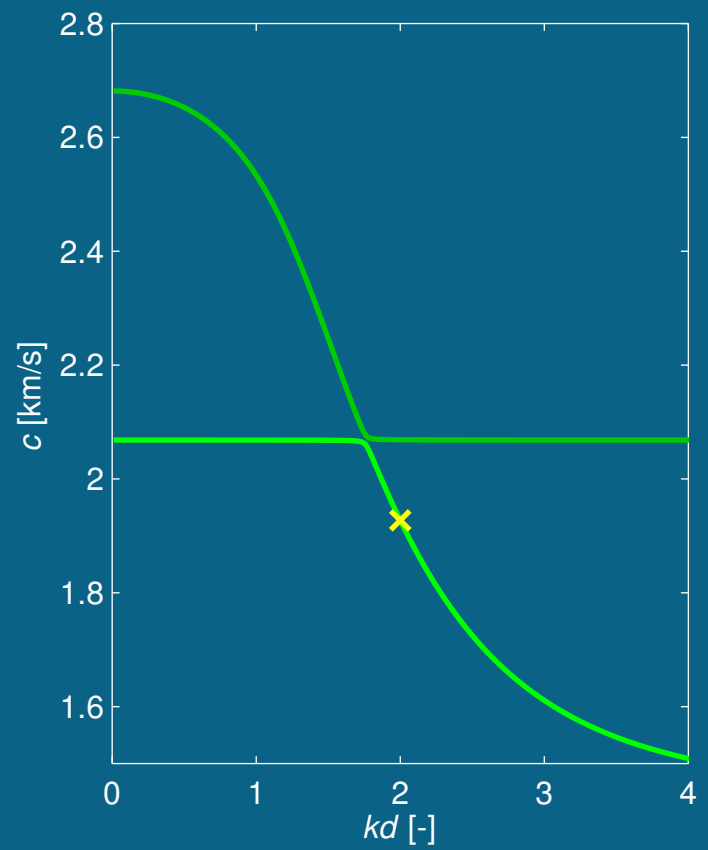
Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.98$



Výchyly pro 1. symetrický mód, směr šíření $\phi = 89^\circ$

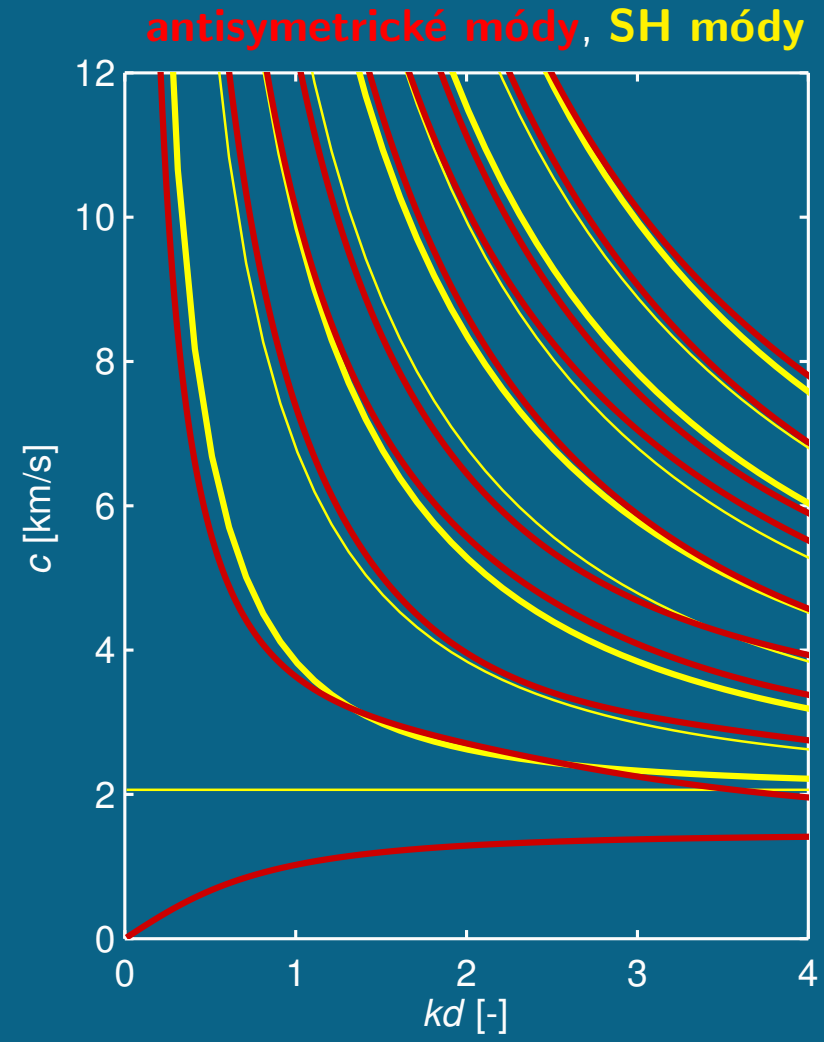
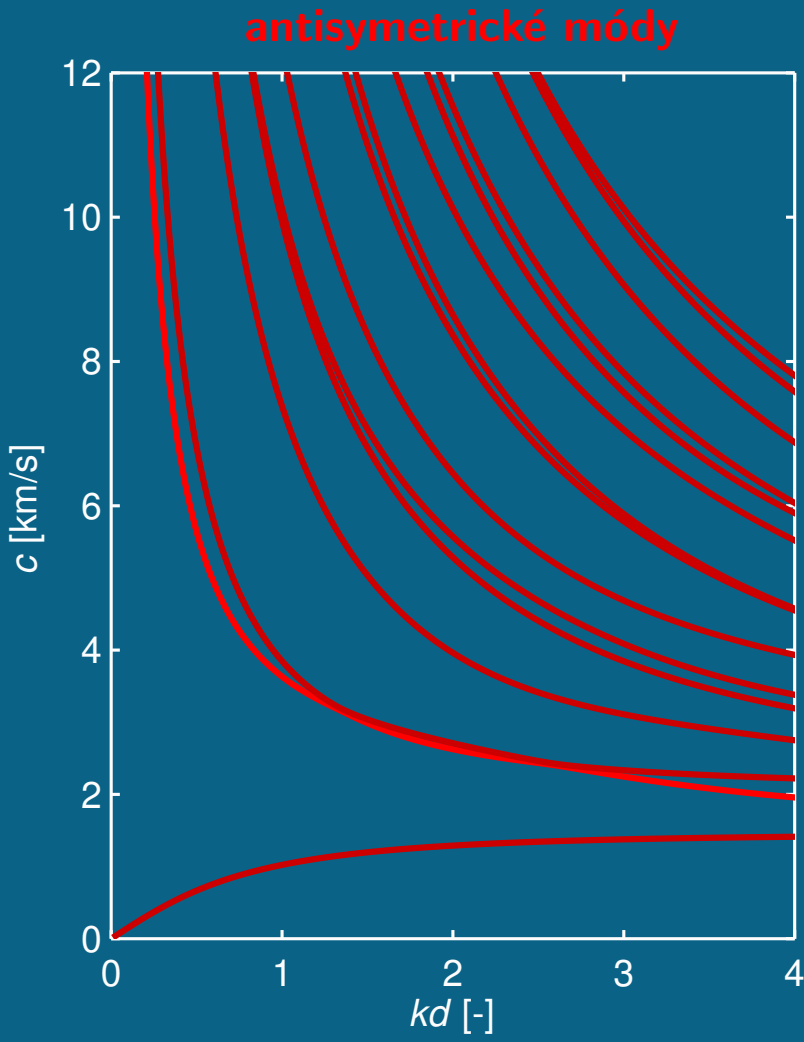
$kd=2.00$



Antisymetrické módy pro směry šíření

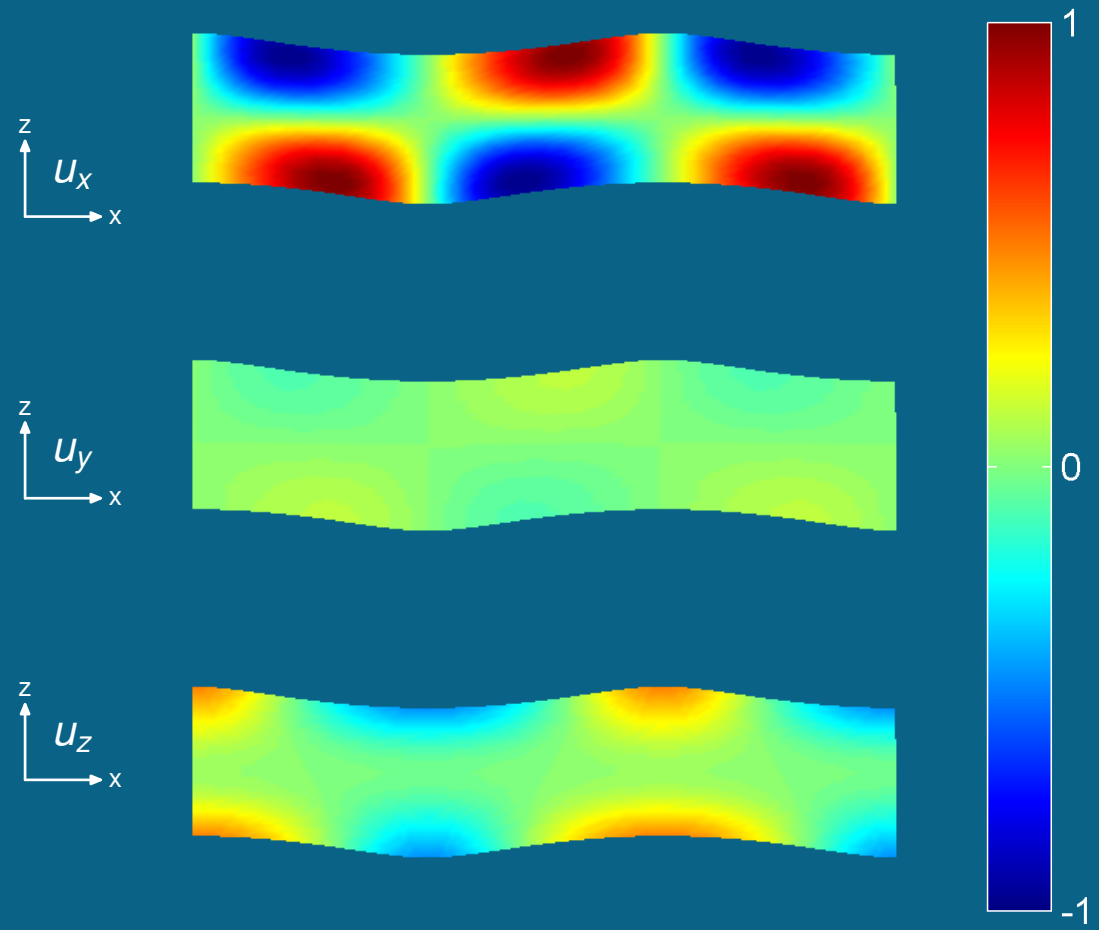
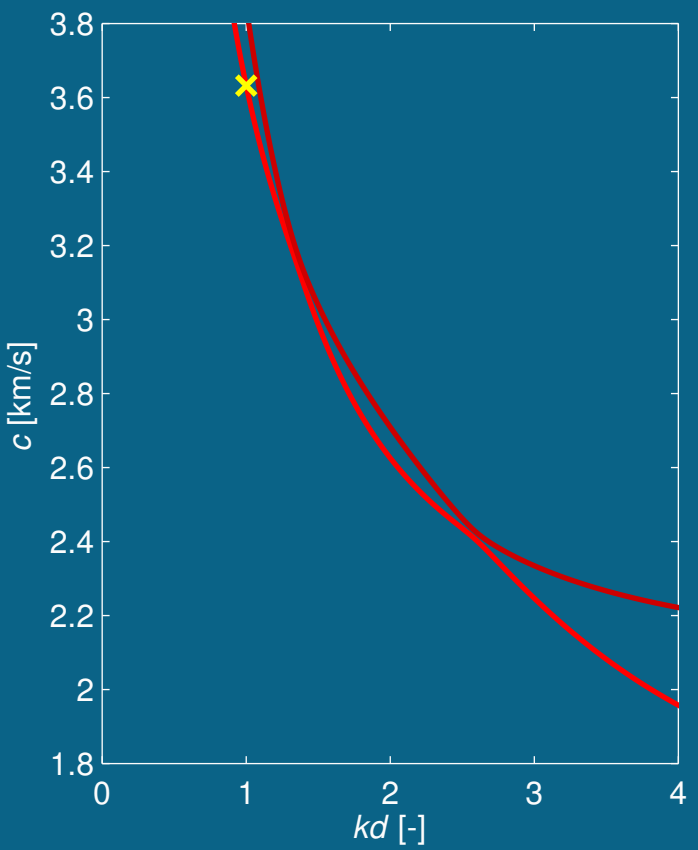
$\phi = 89^\circ$

$\phi = 90^\circ$



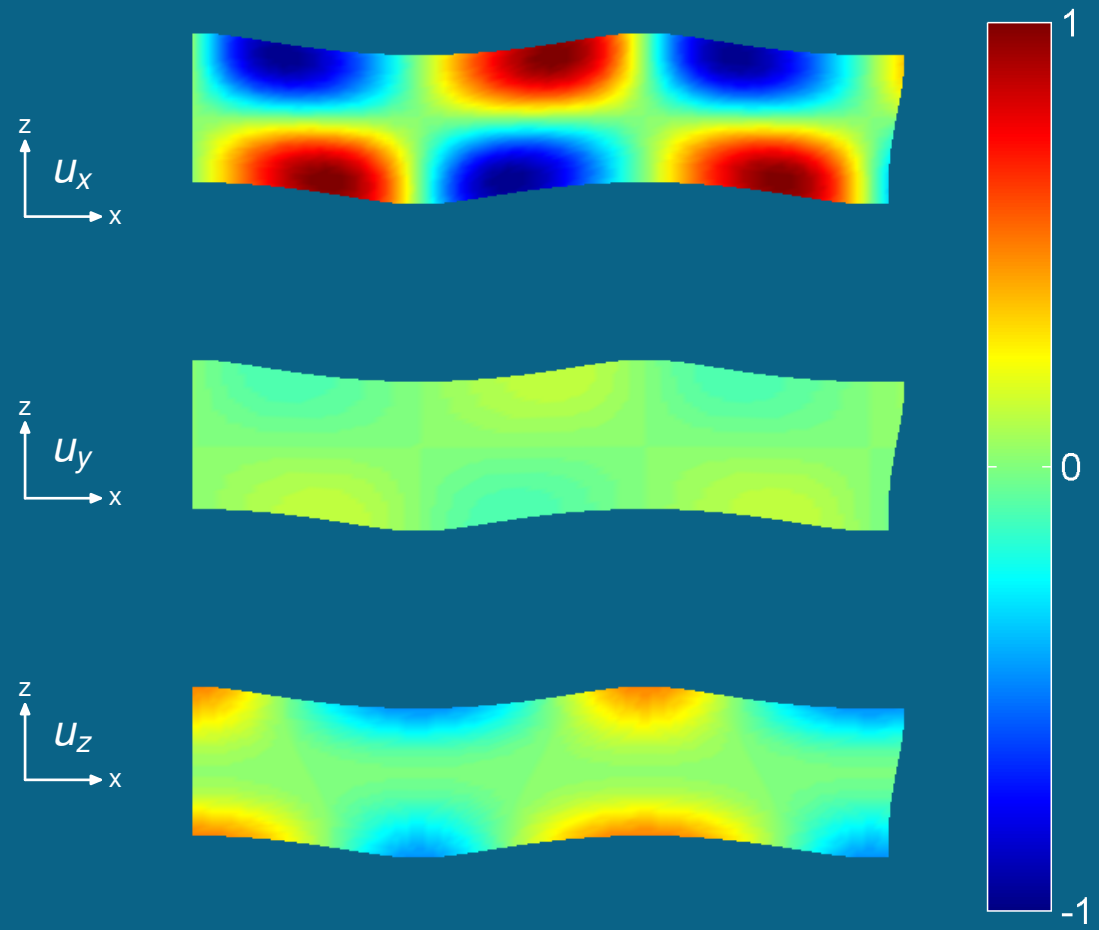
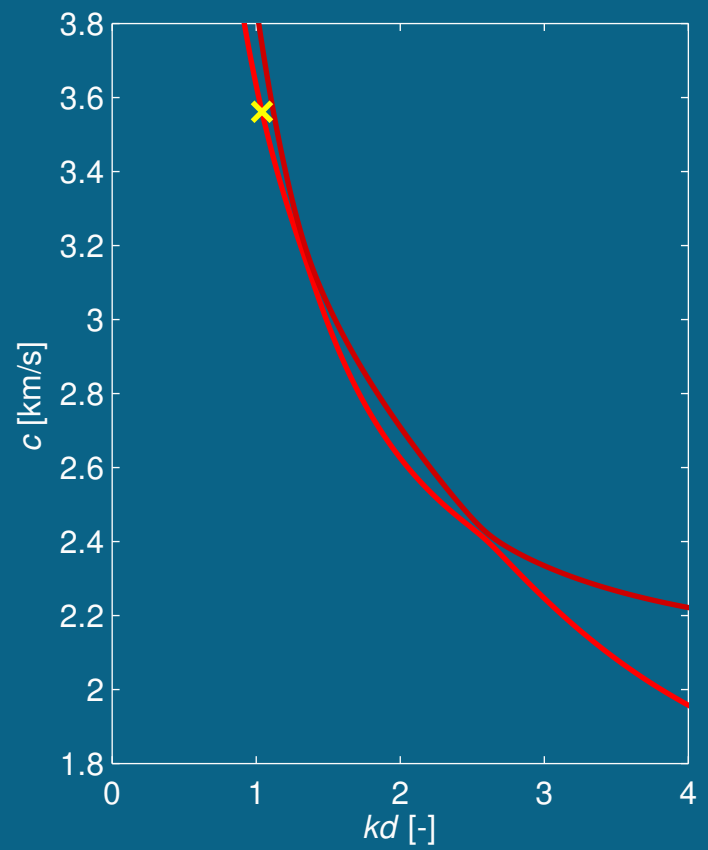
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.00$



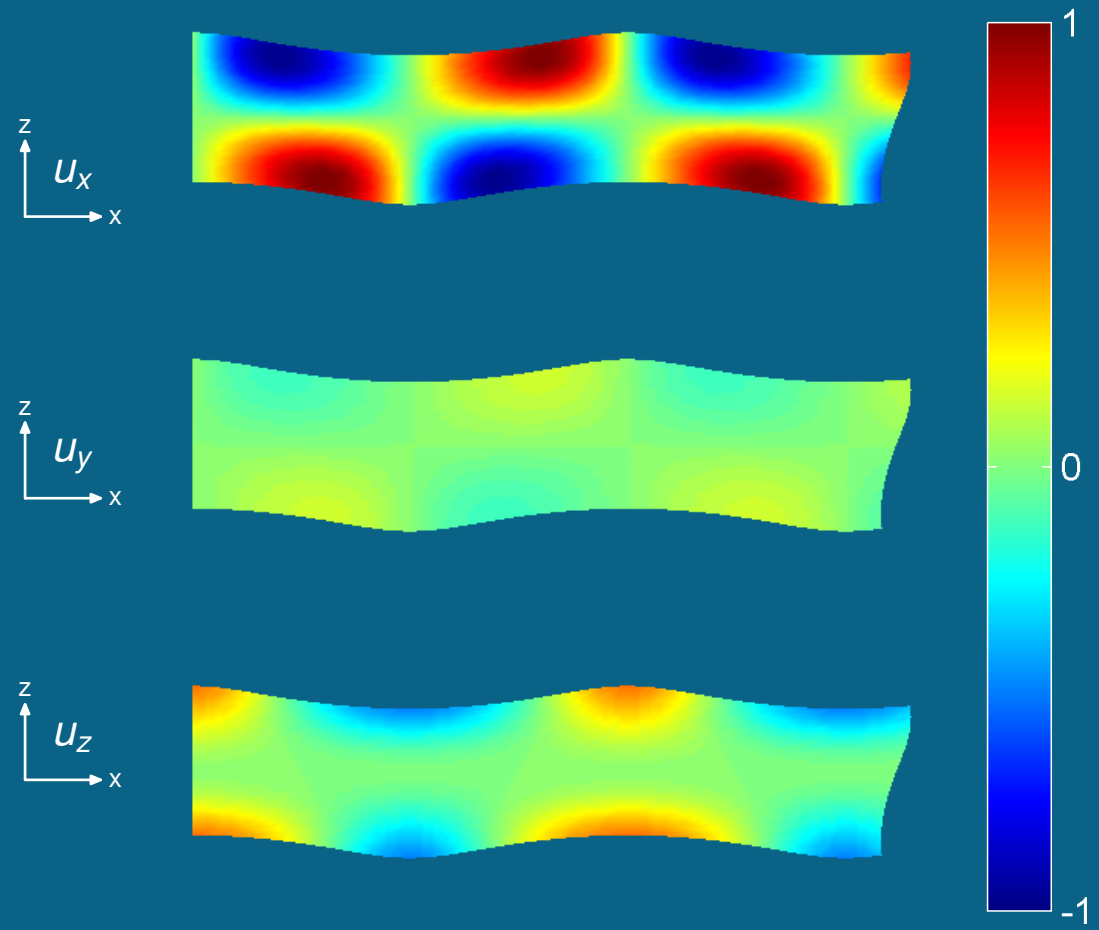
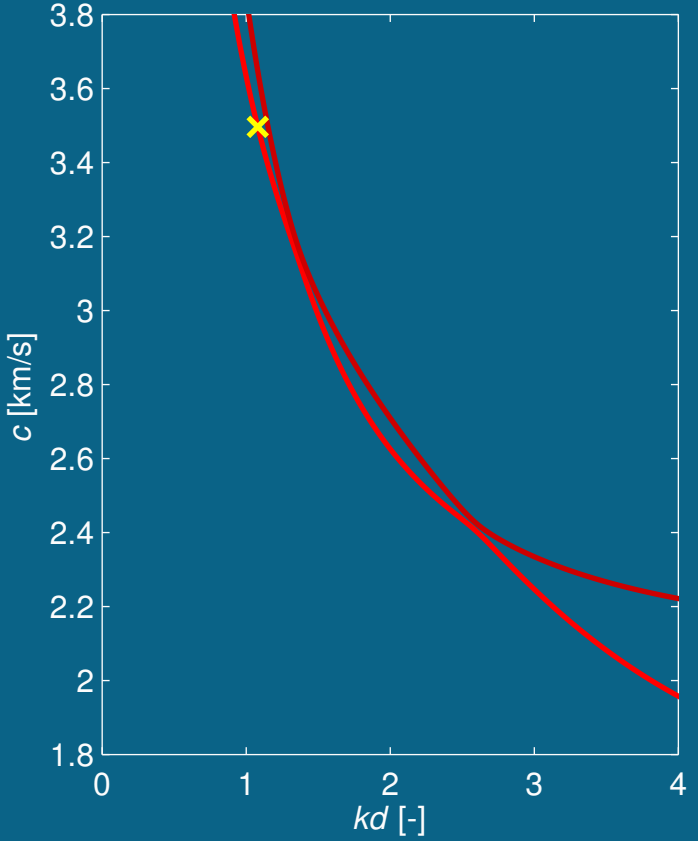
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.04$



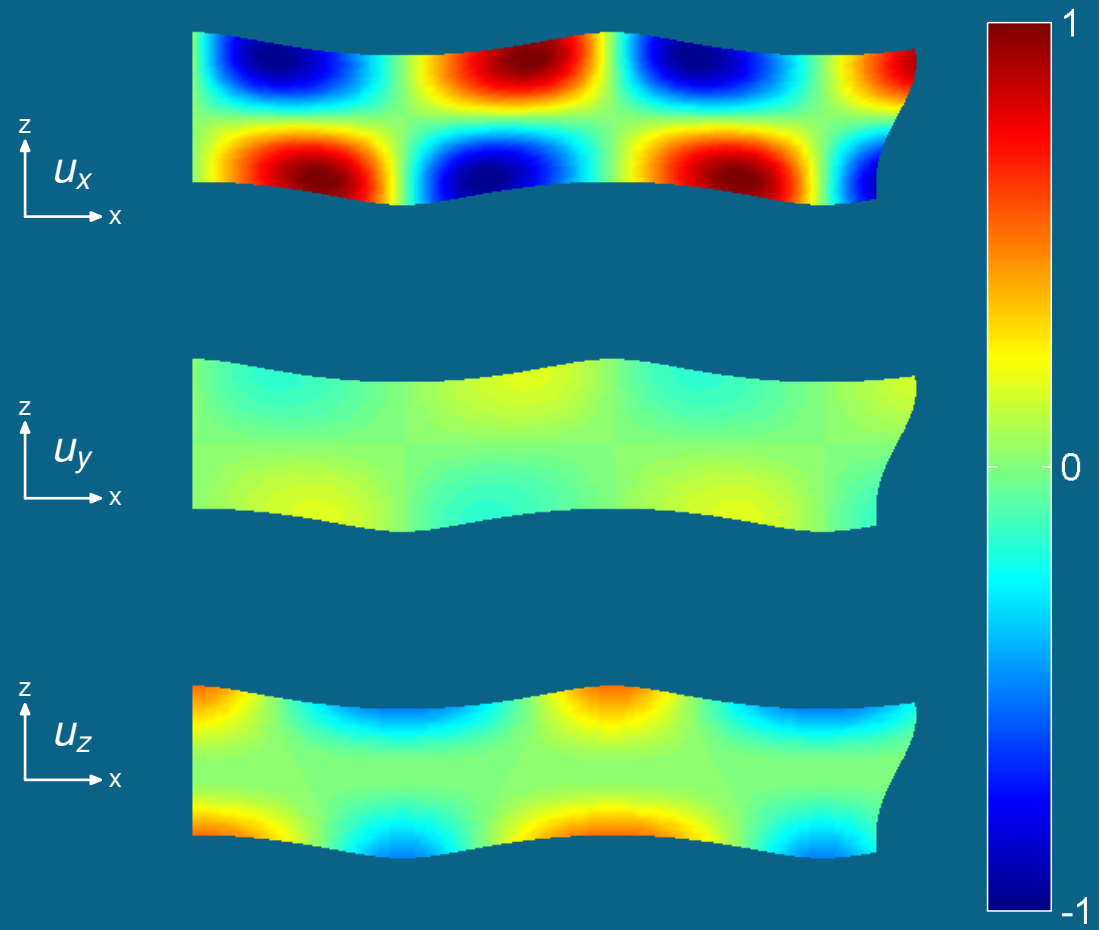
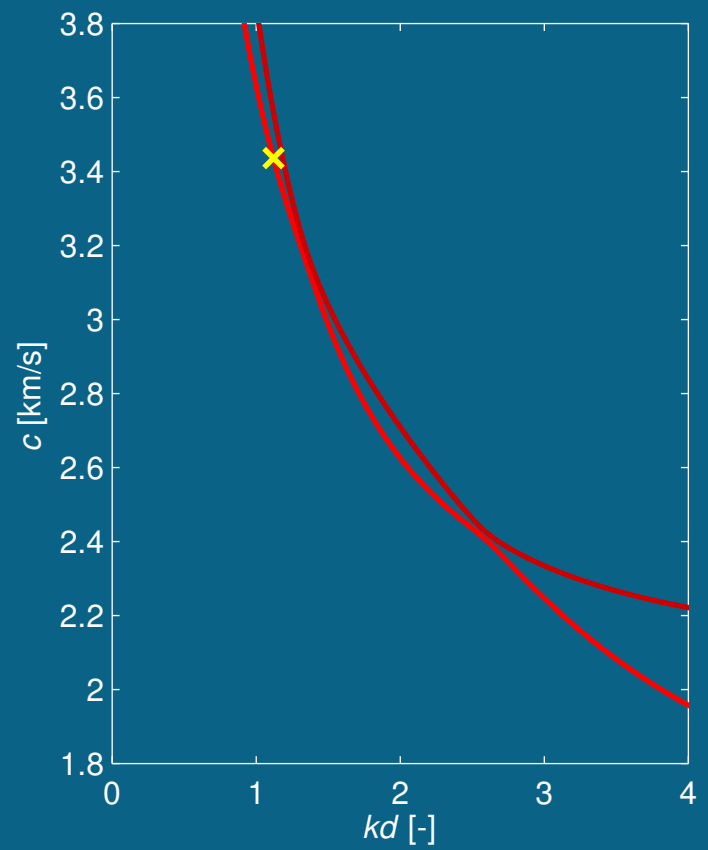
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.08$



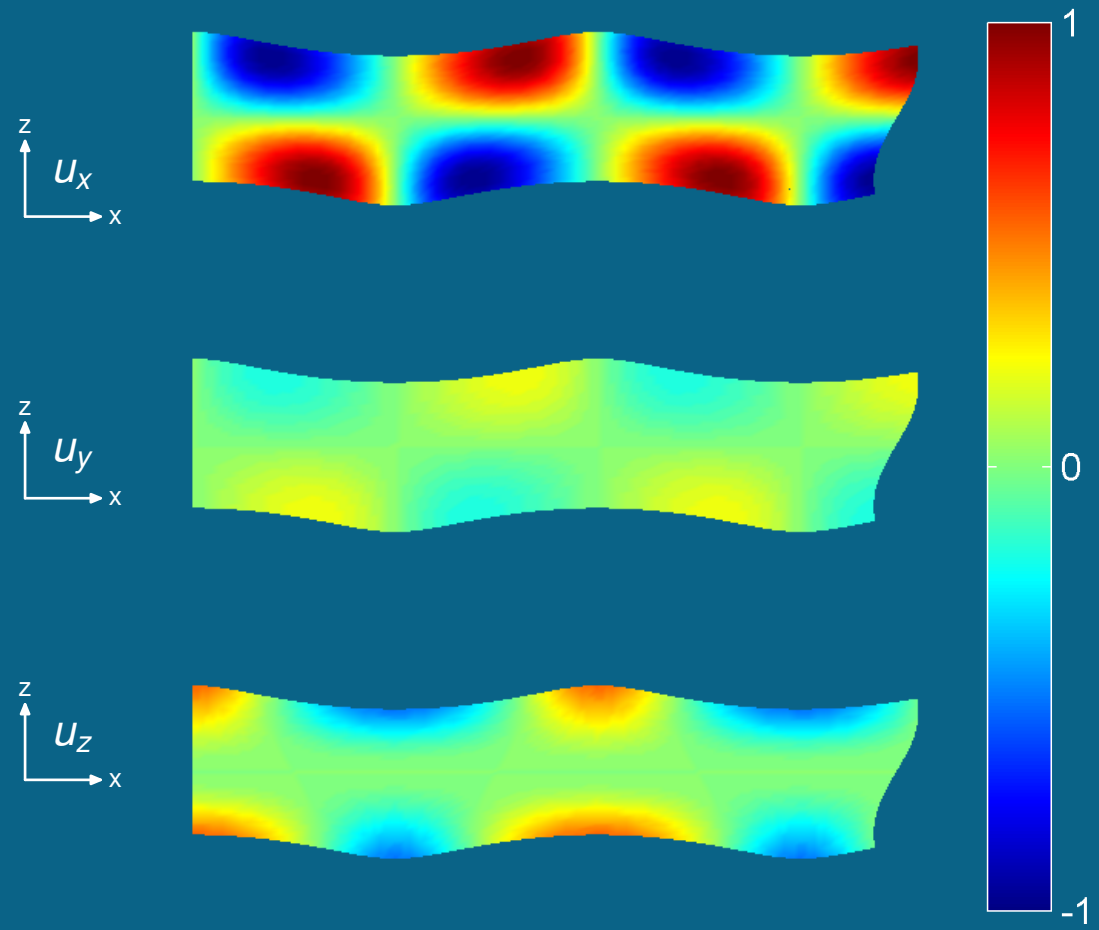
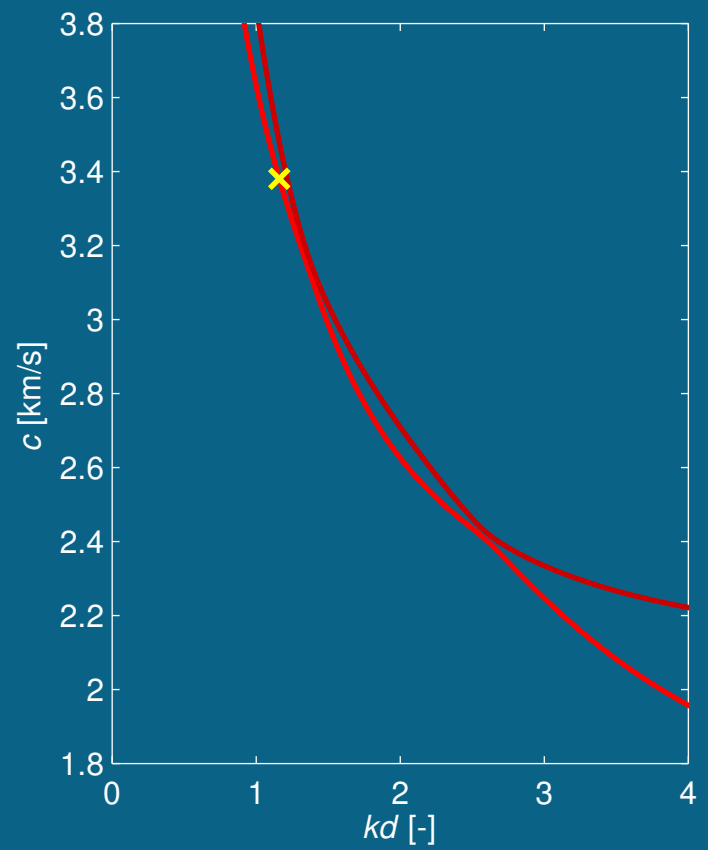
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.12$



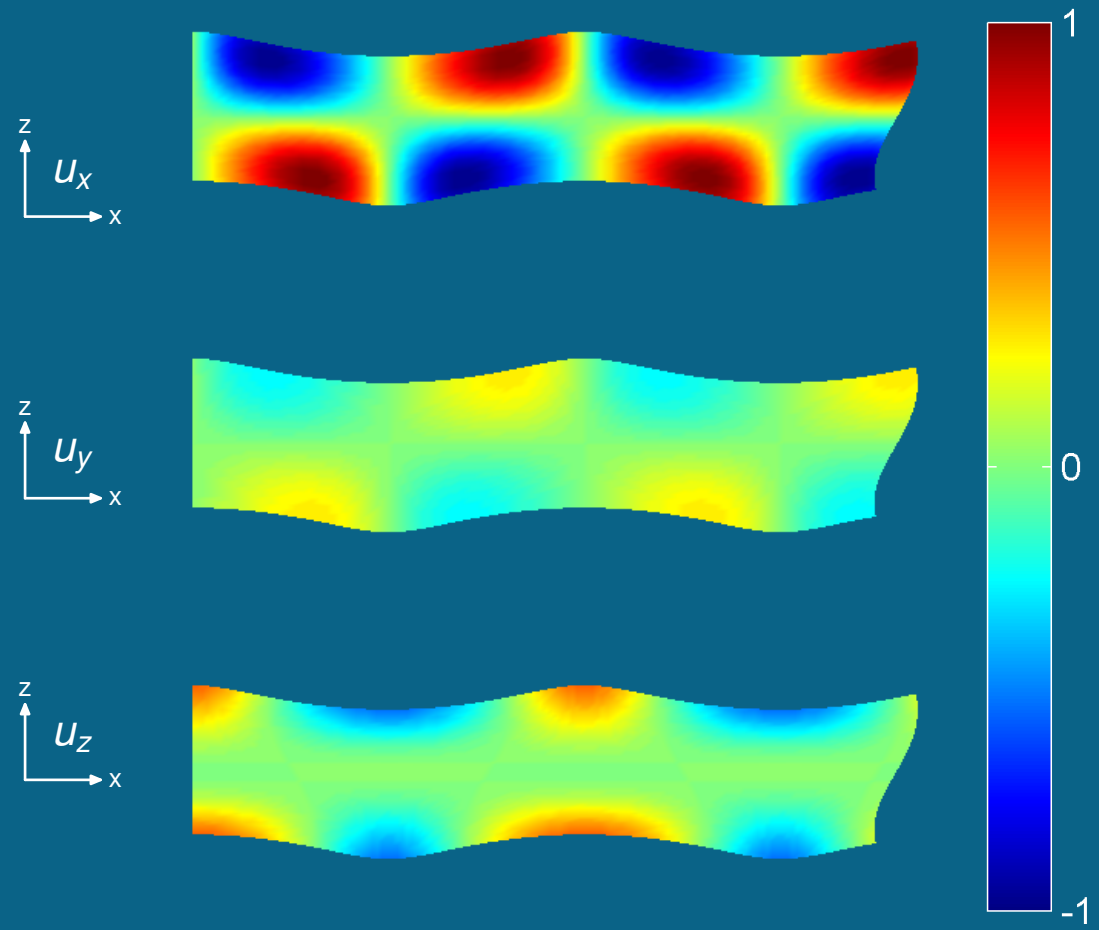
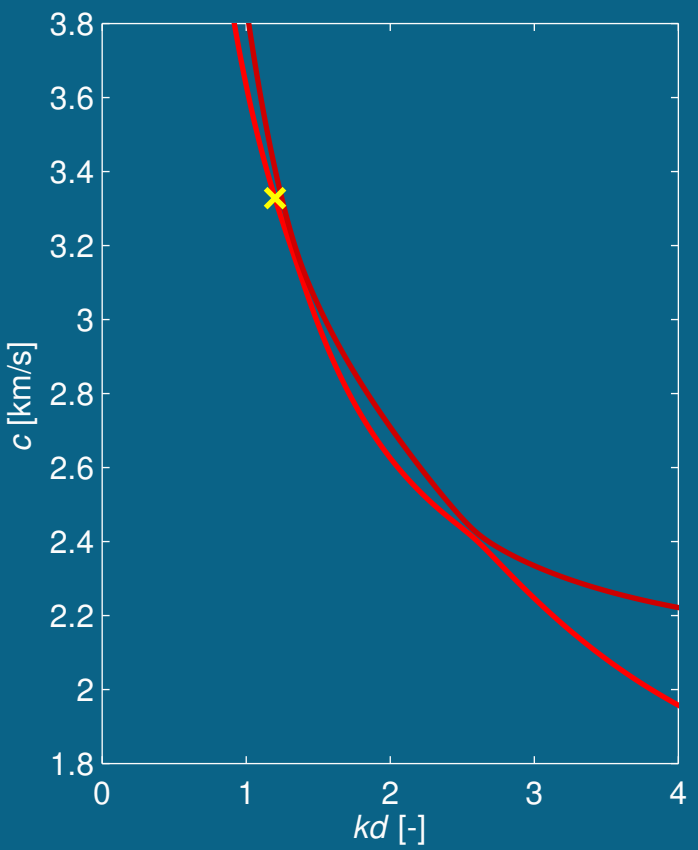
Výhybky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.16$



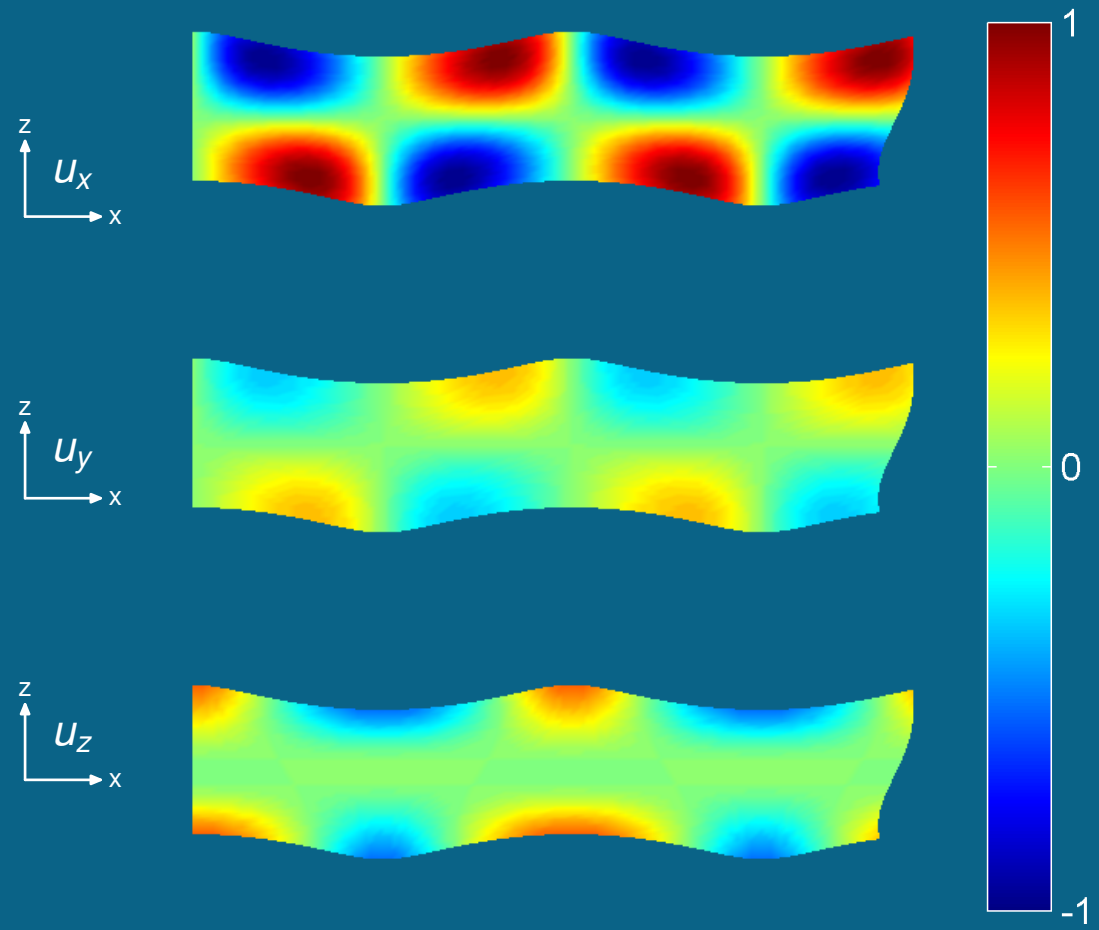
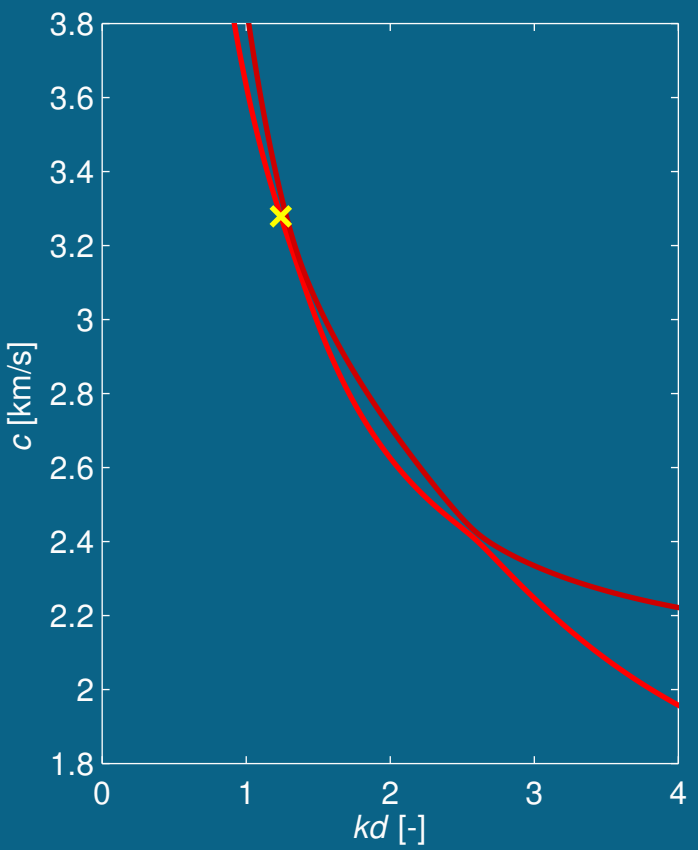
Výchyly pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.20$



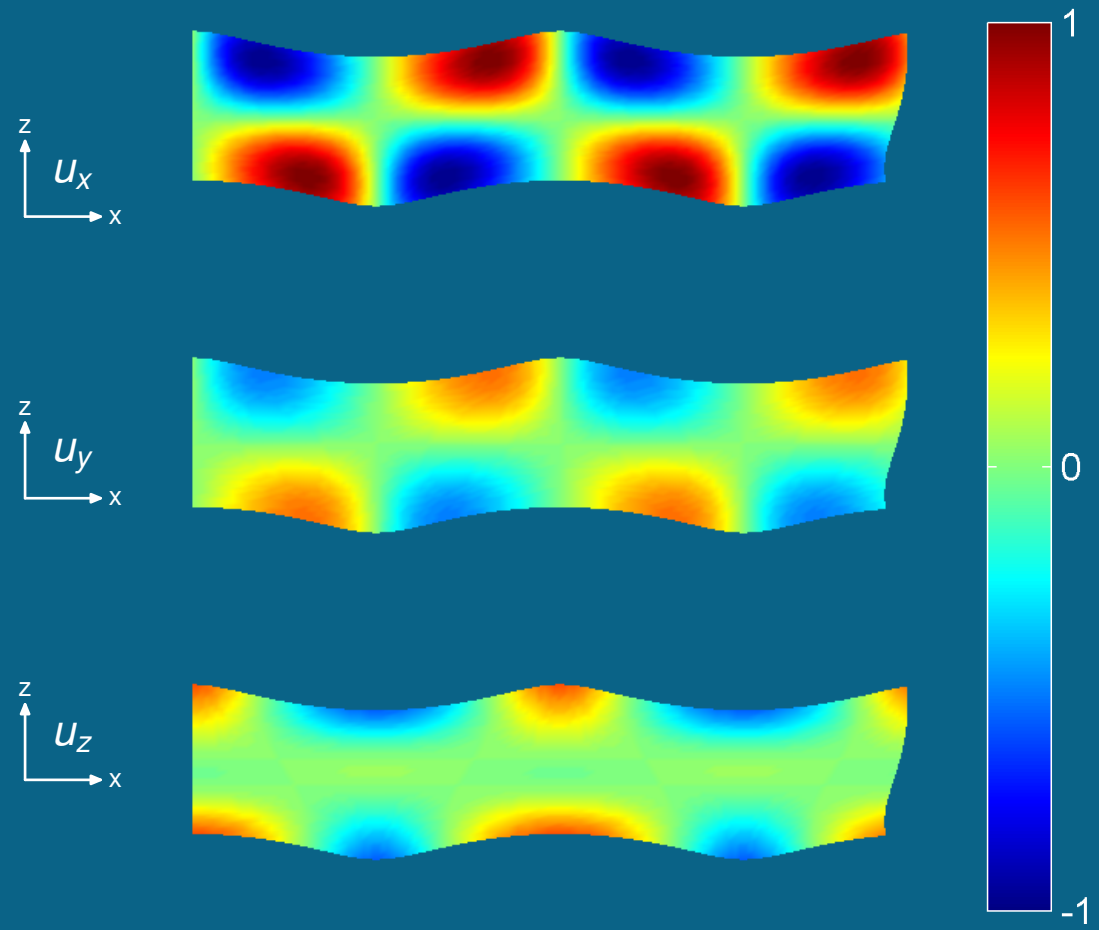
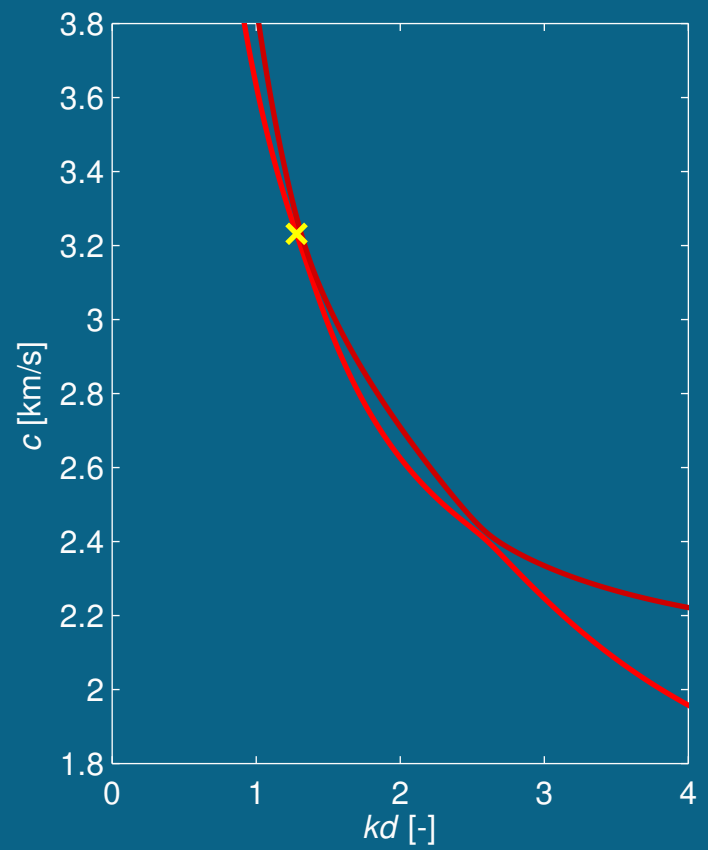
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.24$



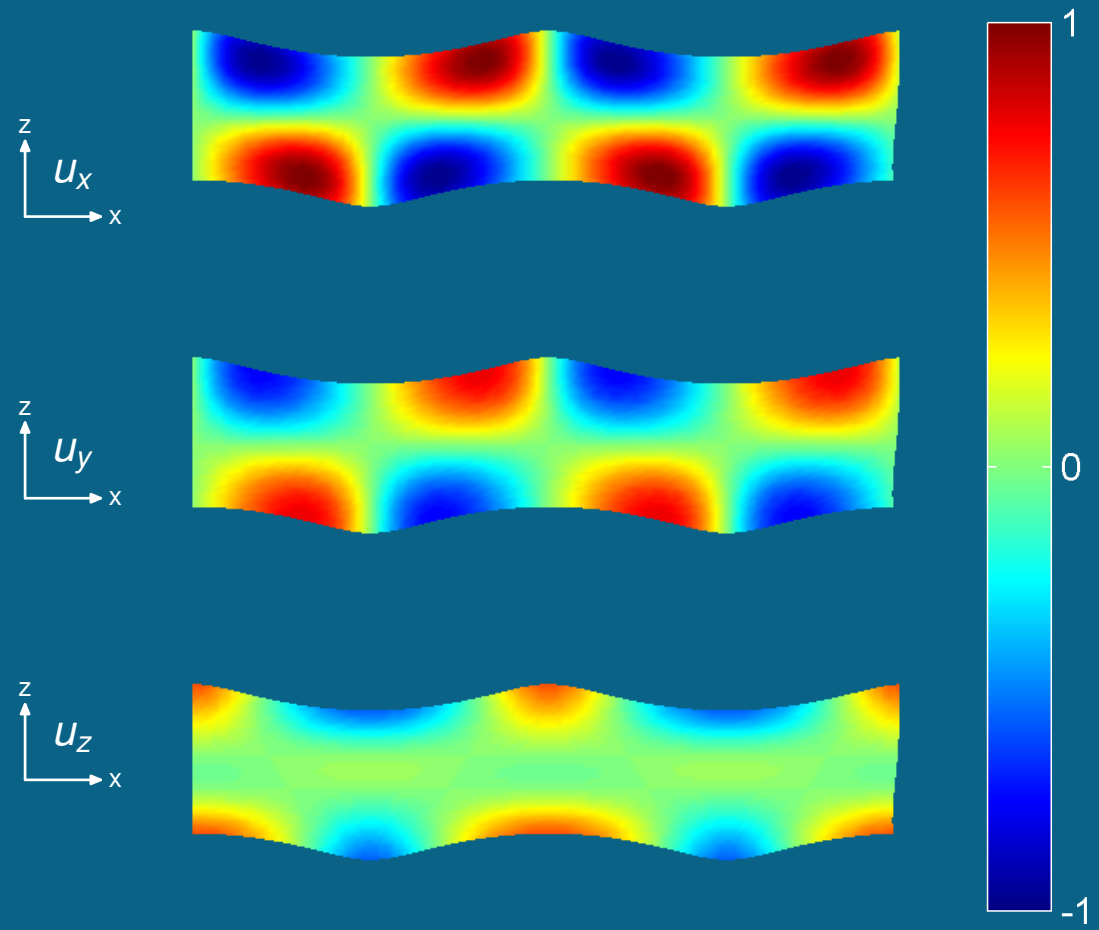
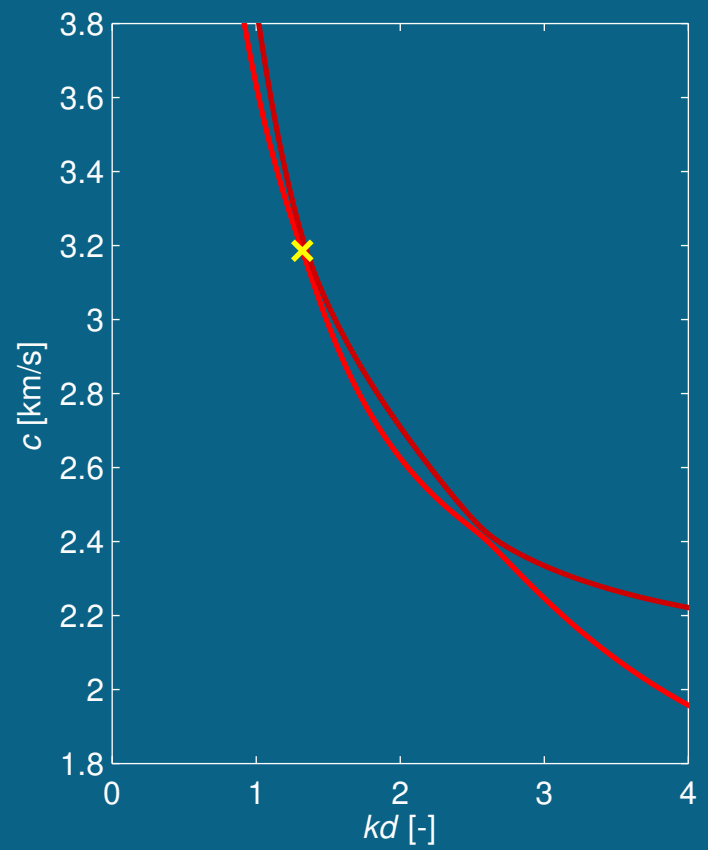
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.28$



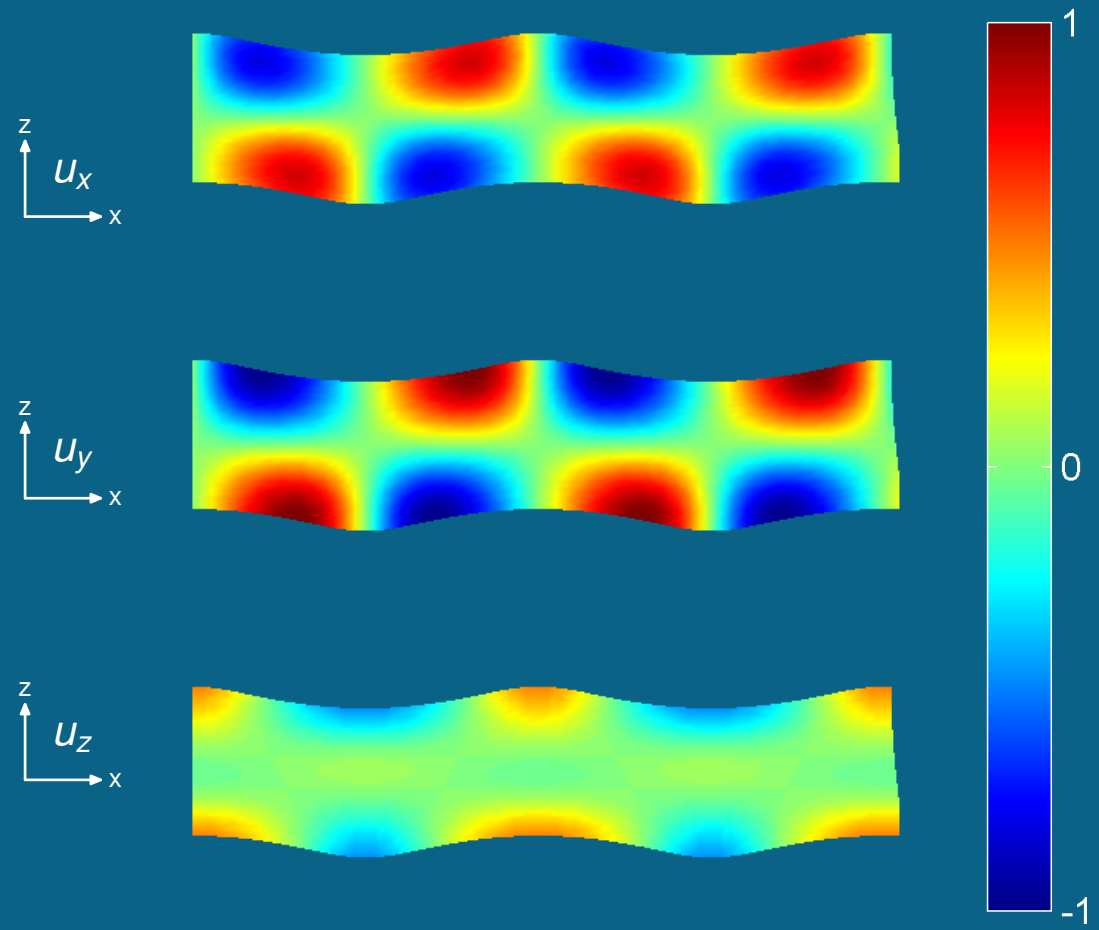
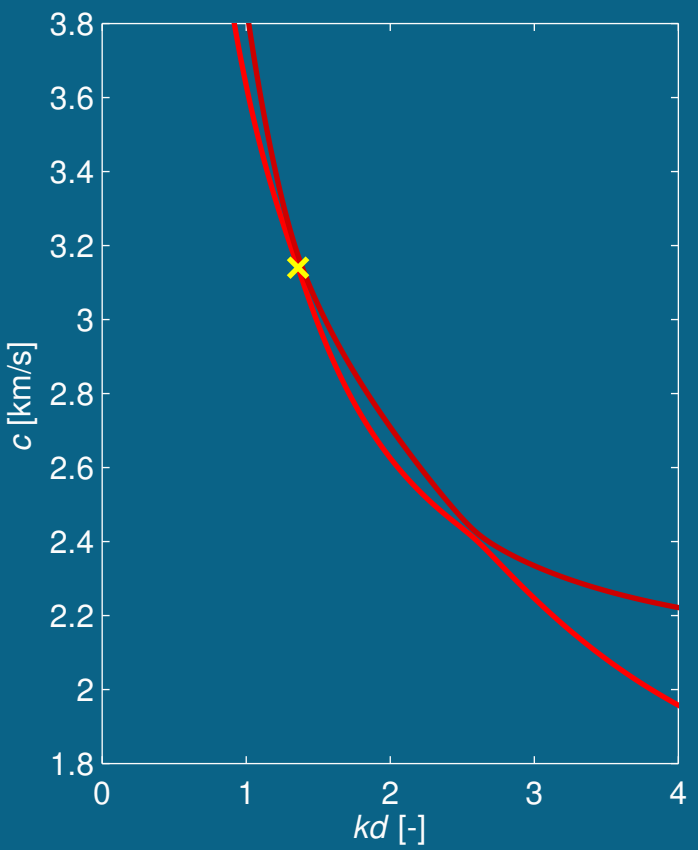
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.32$



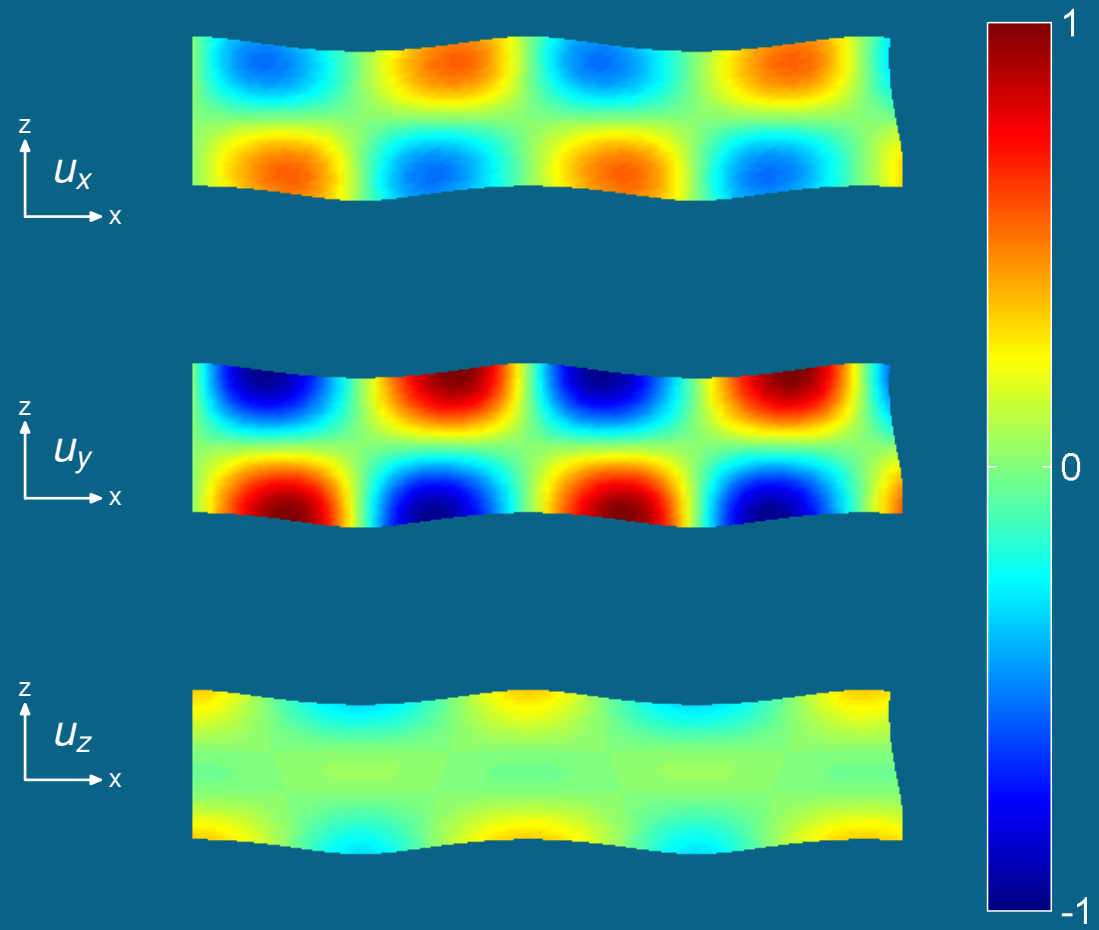
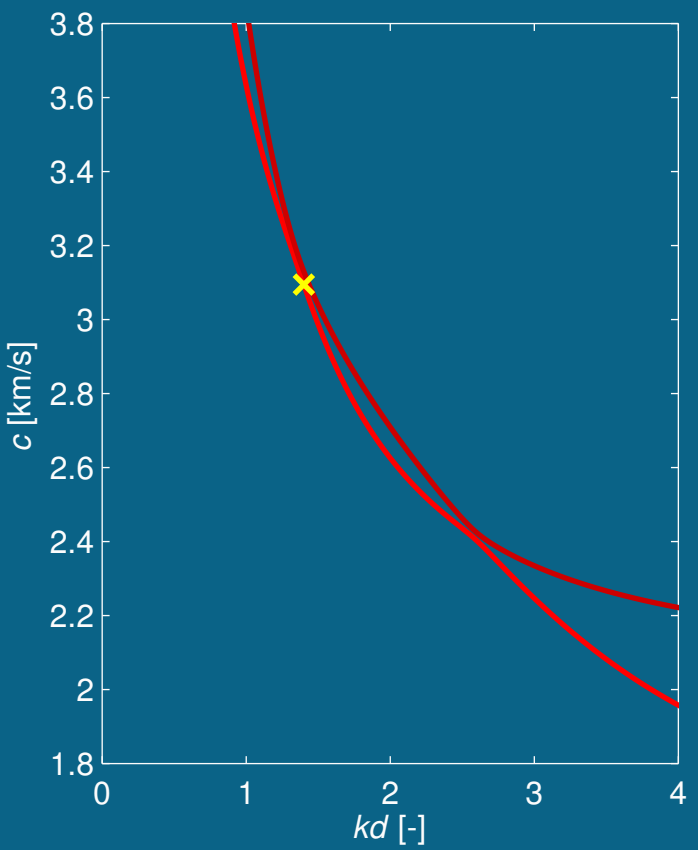
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.36$



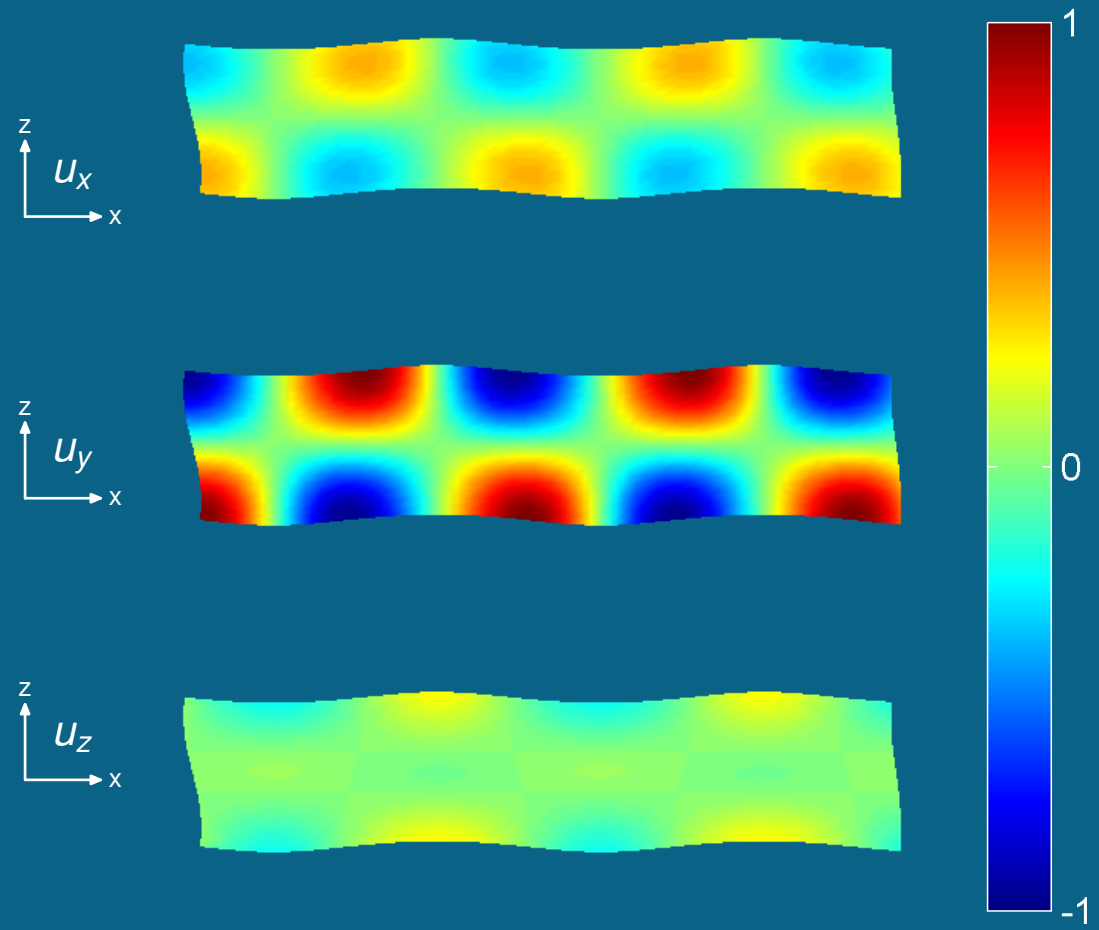
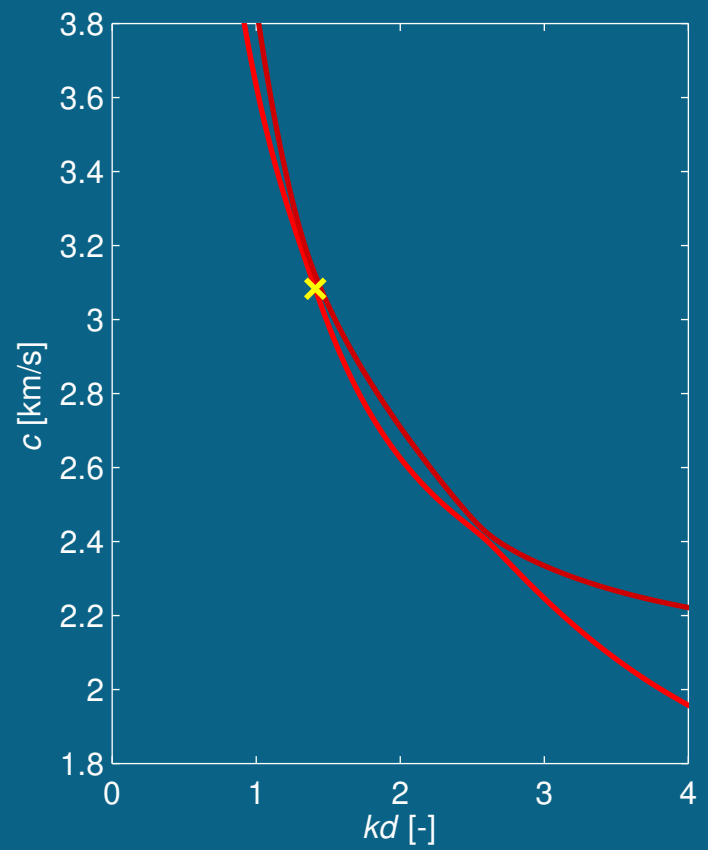
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.40$



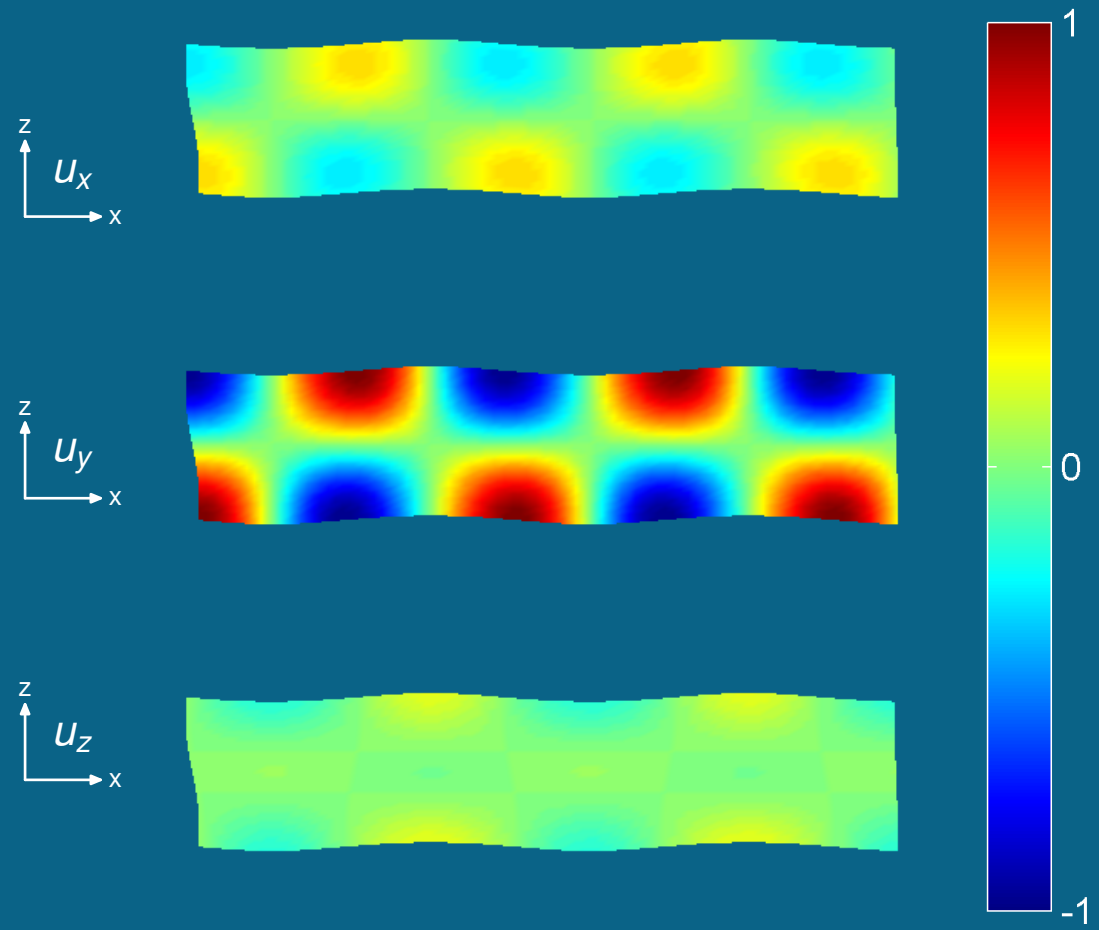
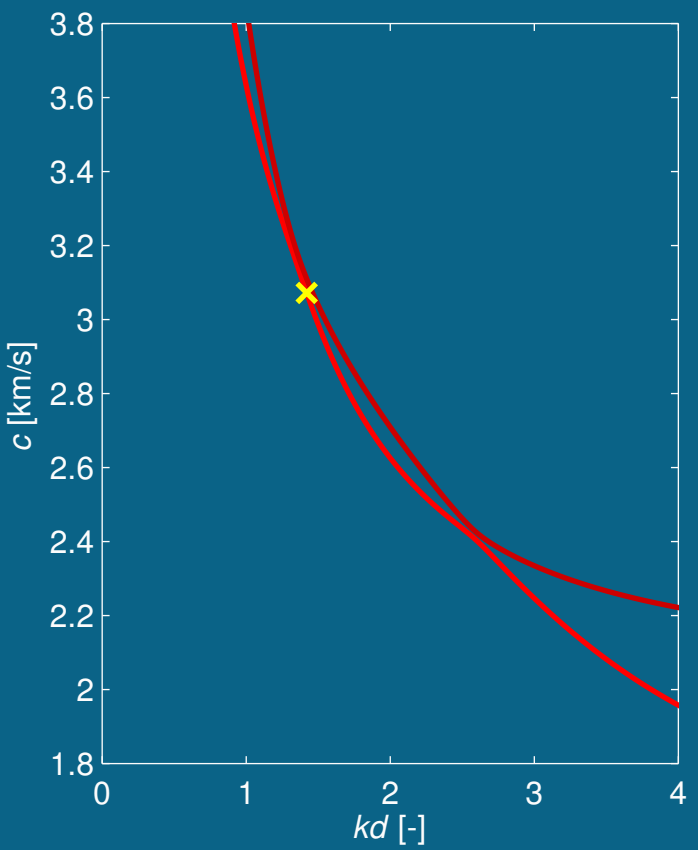
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.44$



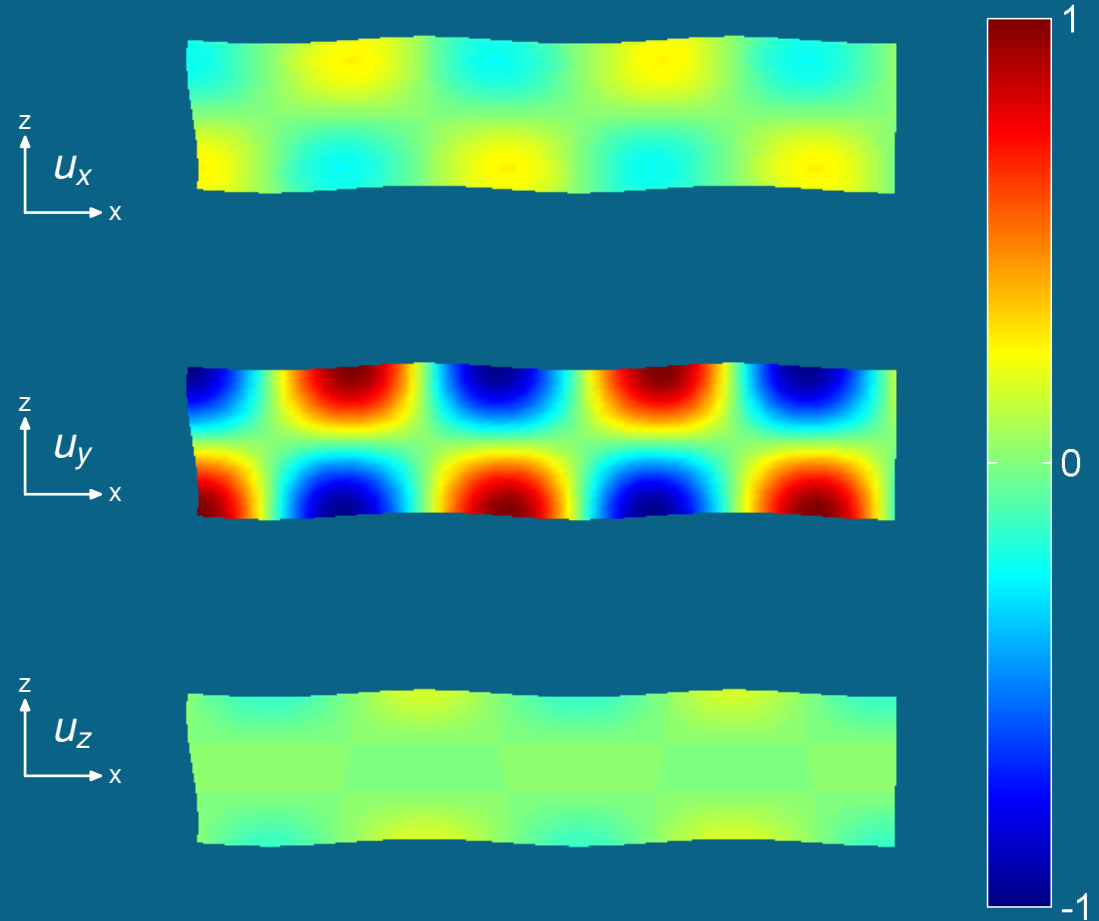
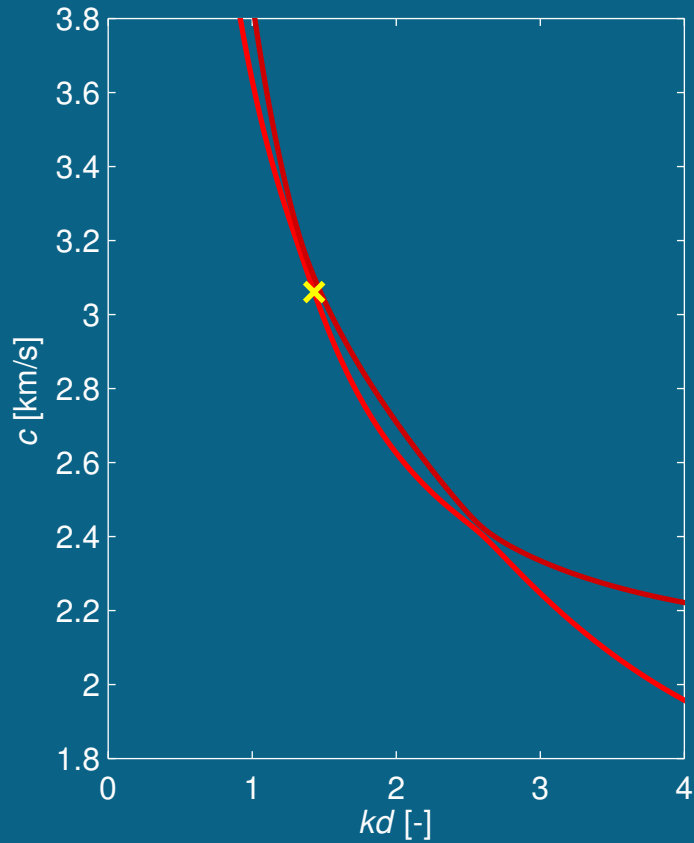
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.48$



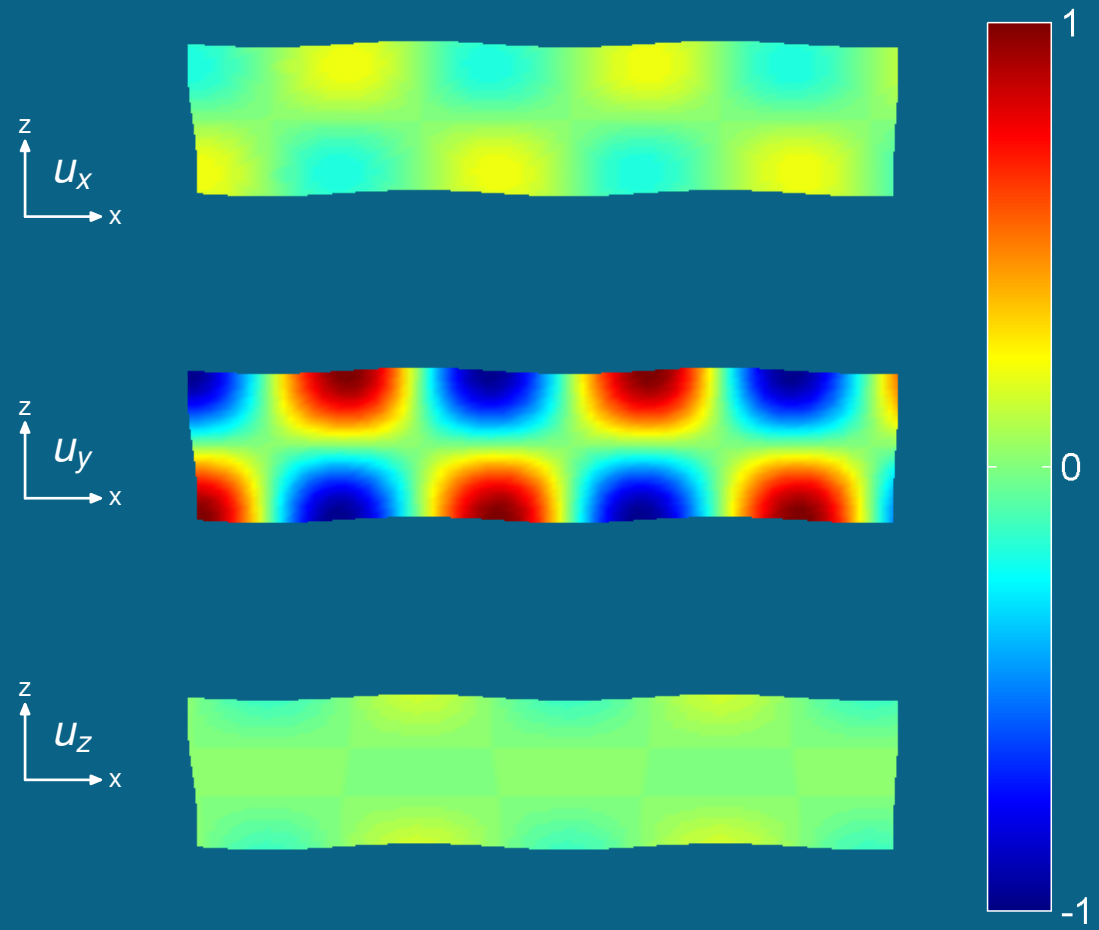
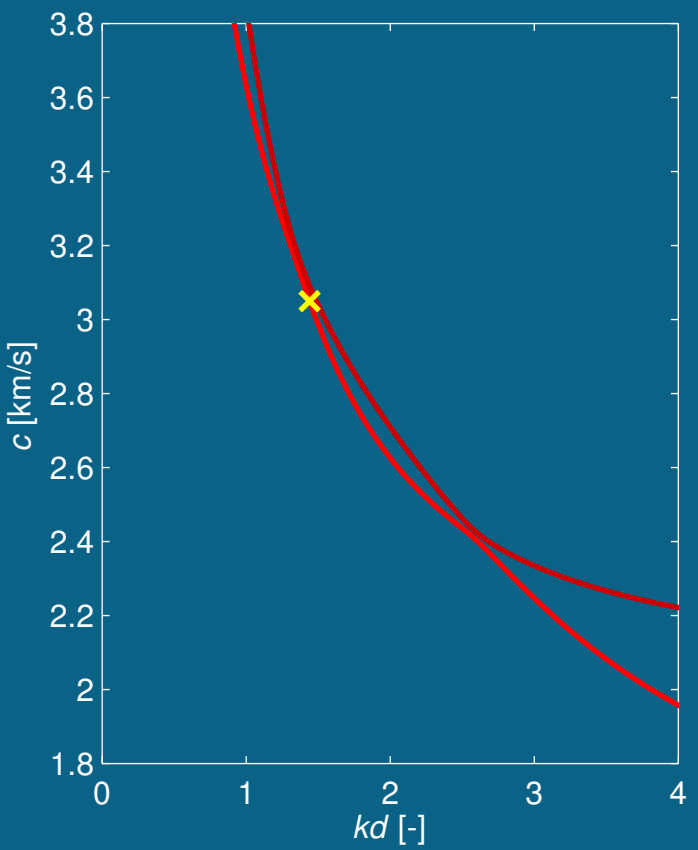
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.52$



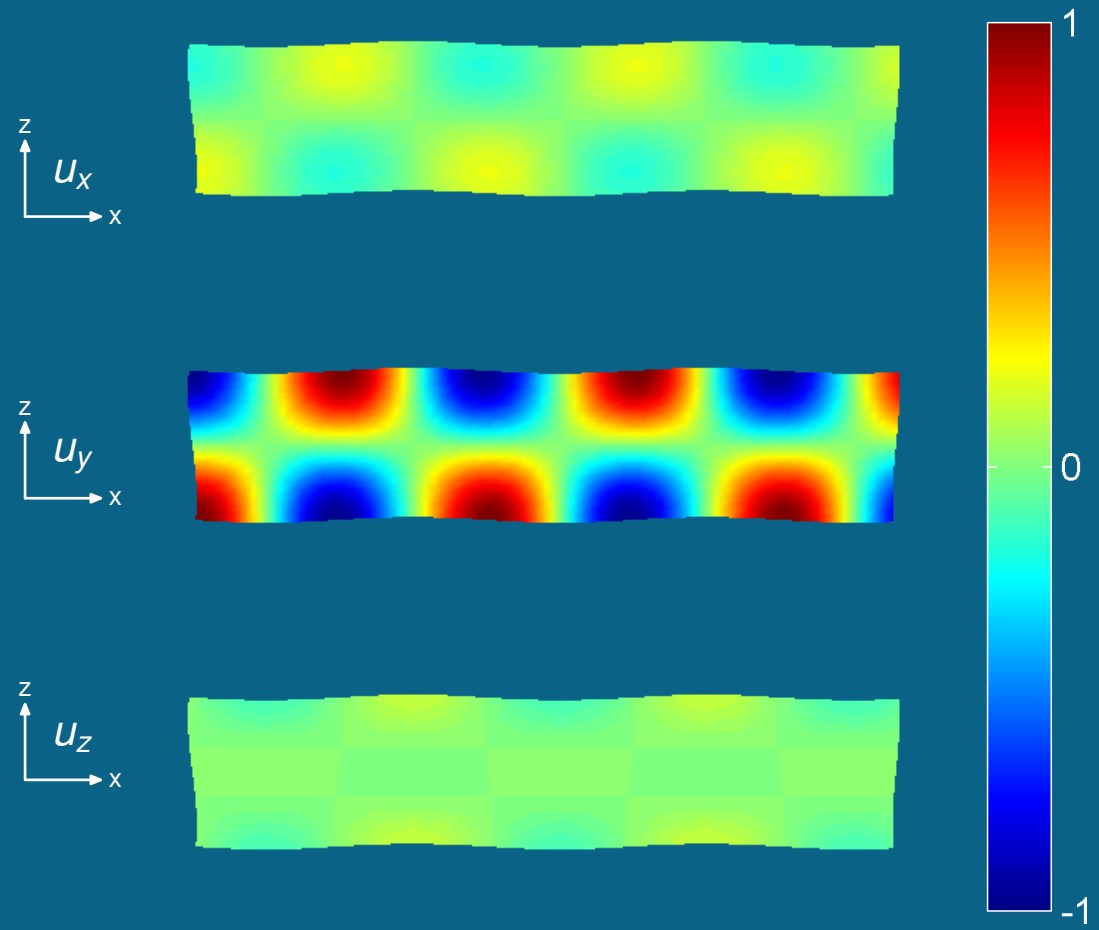
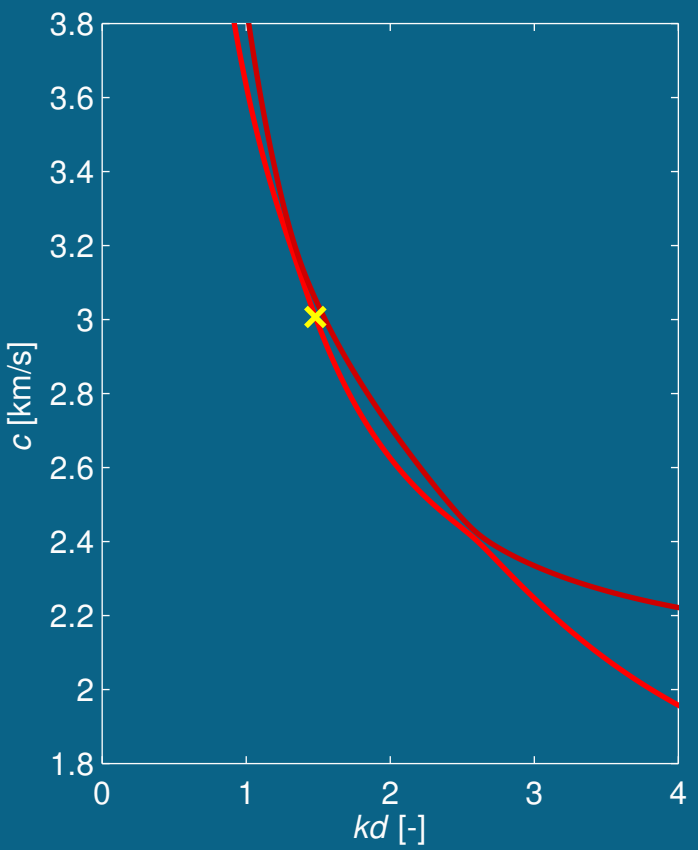
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.56$



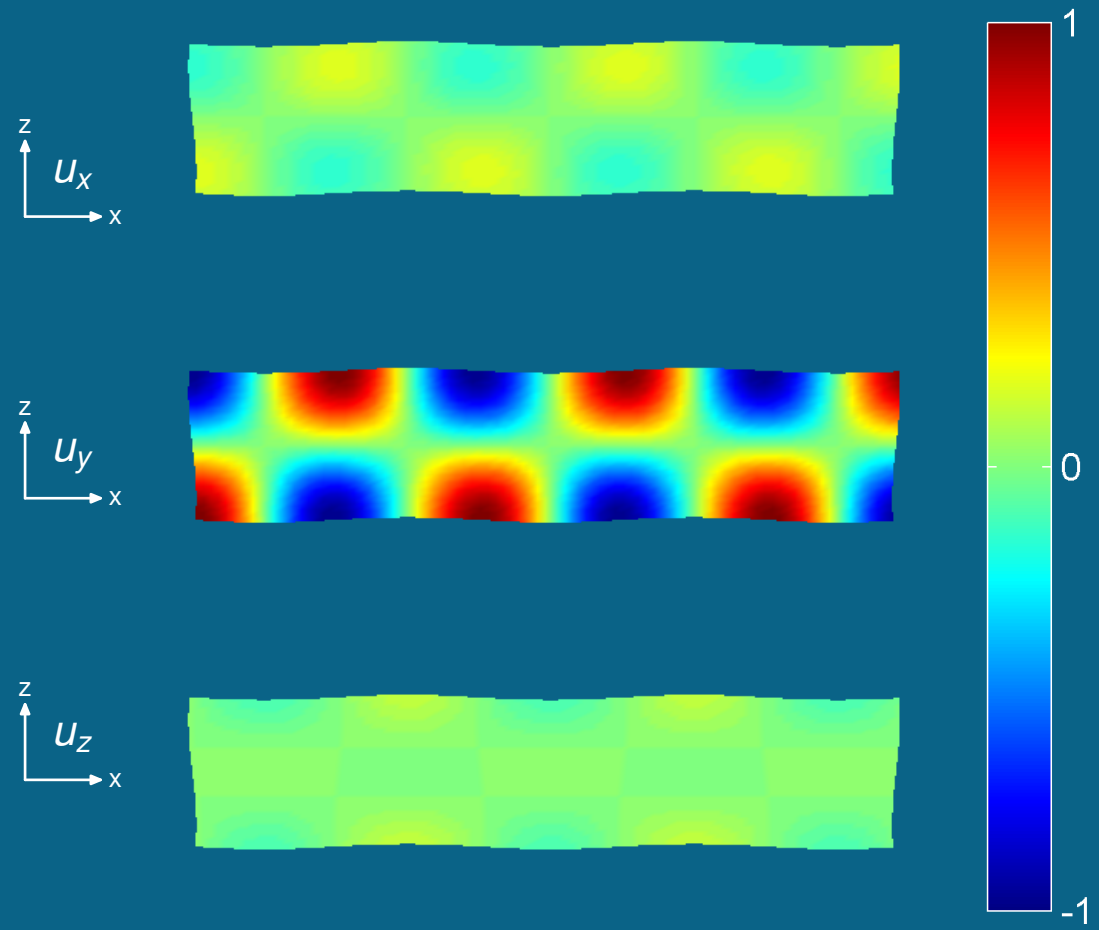
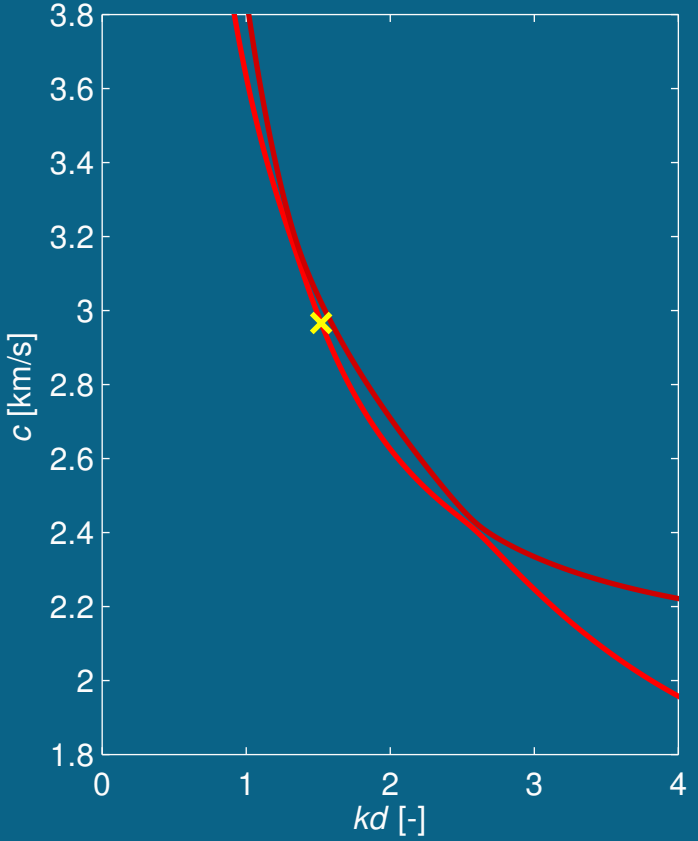
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.60$



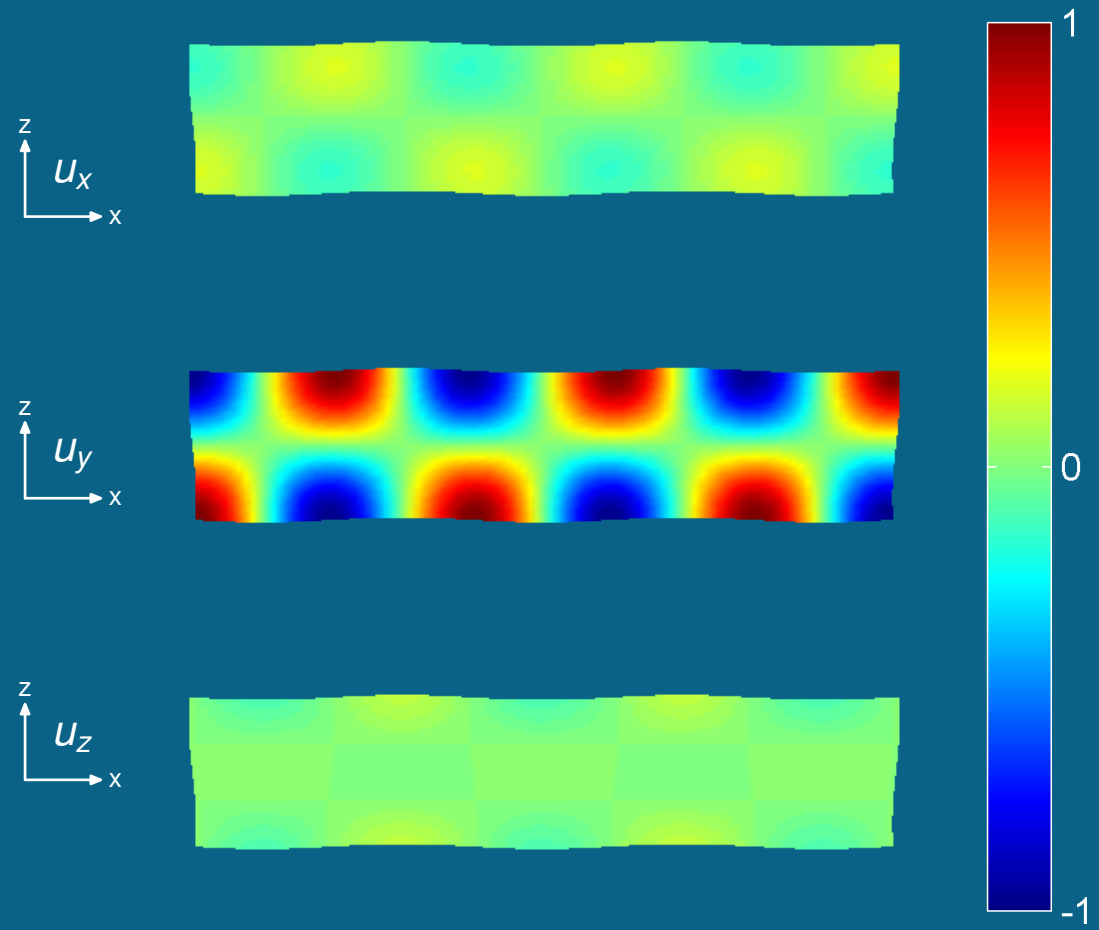
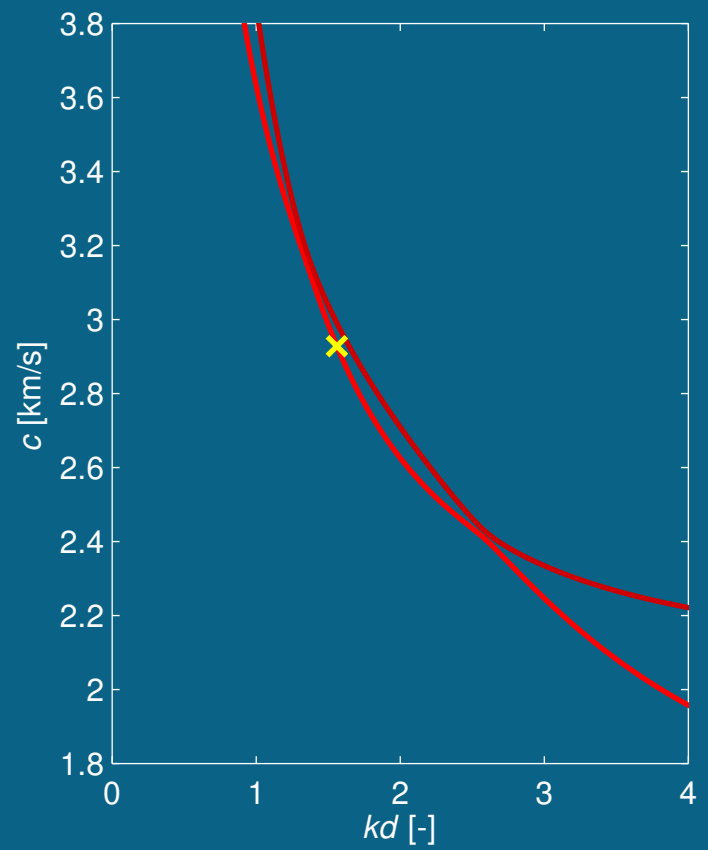
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.64$



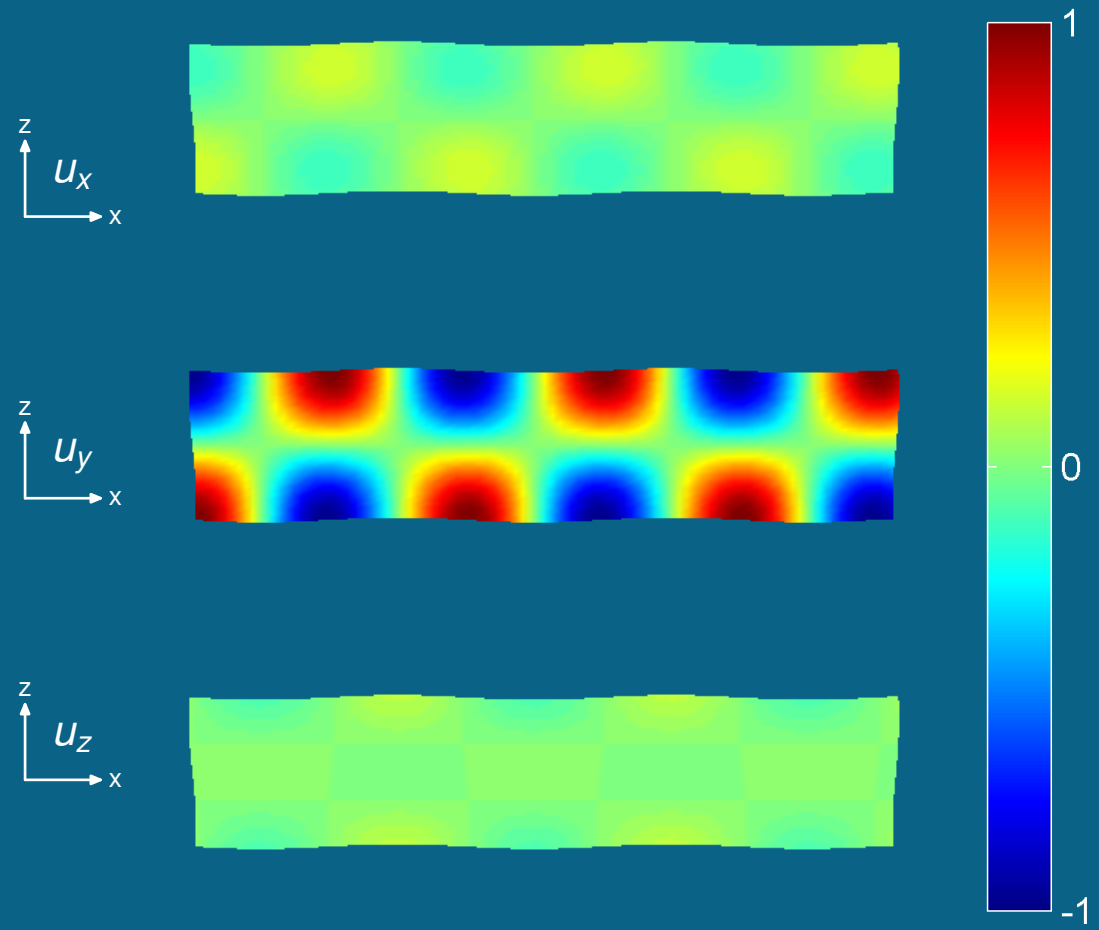
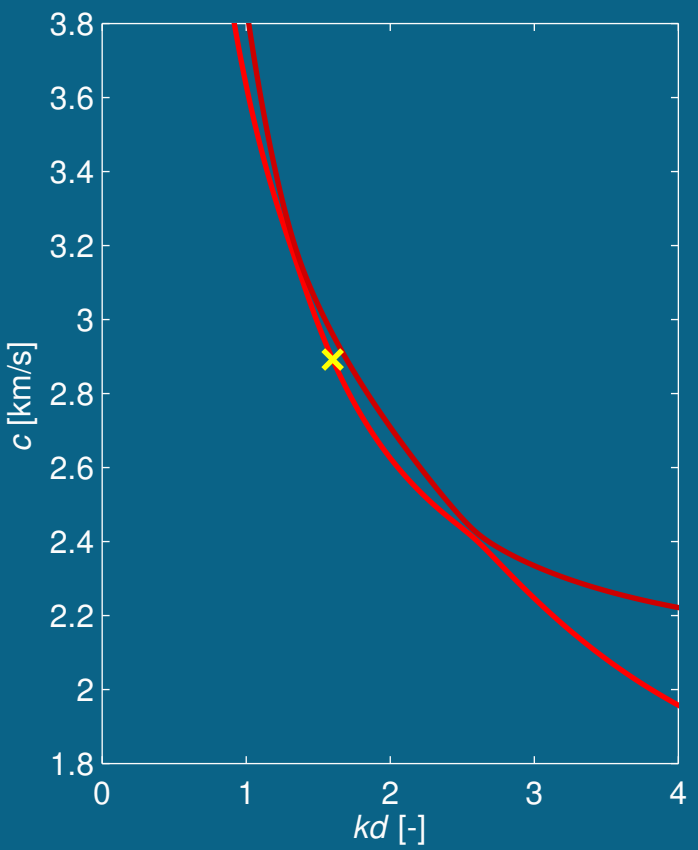
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.68$



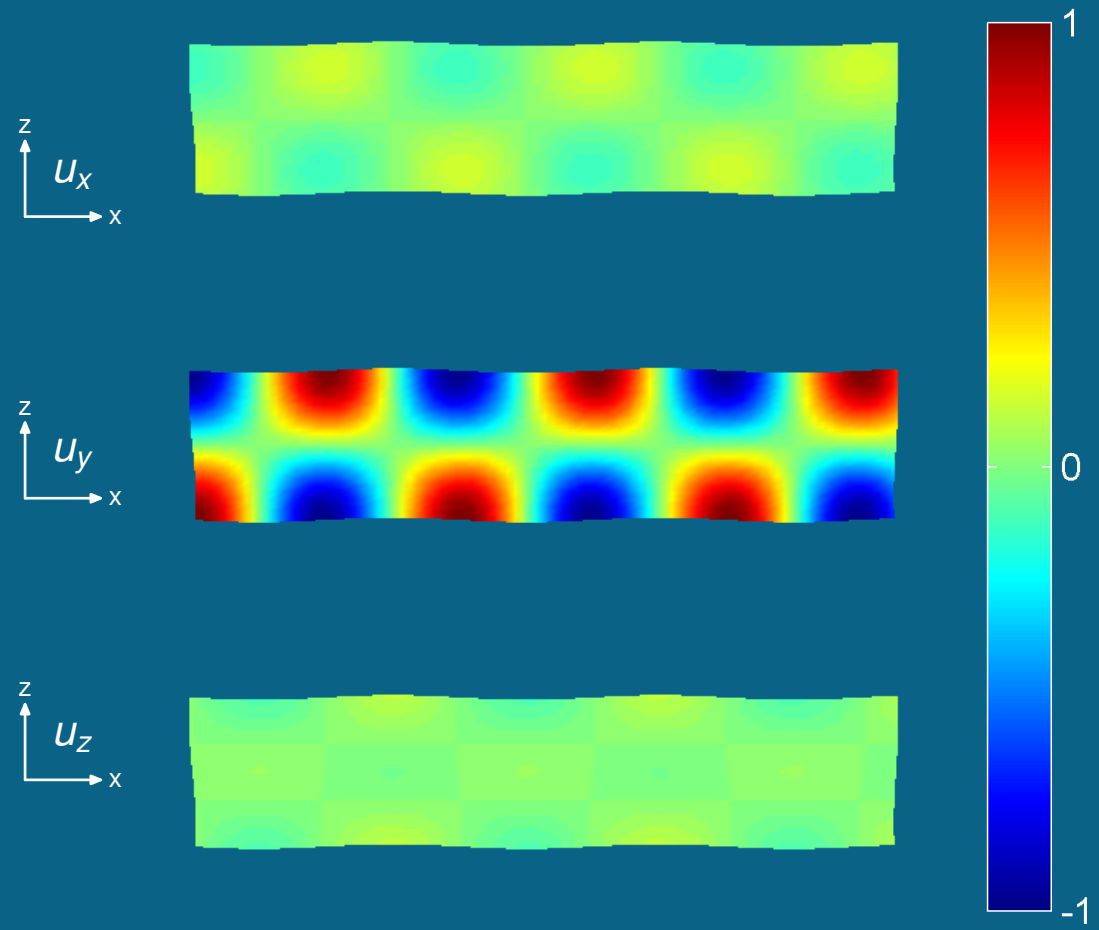
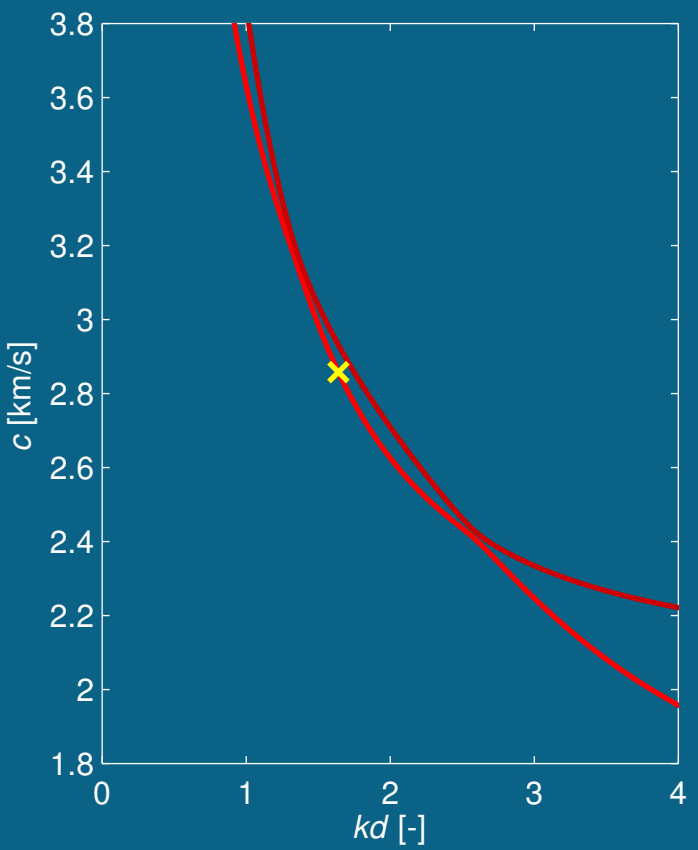
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.72$



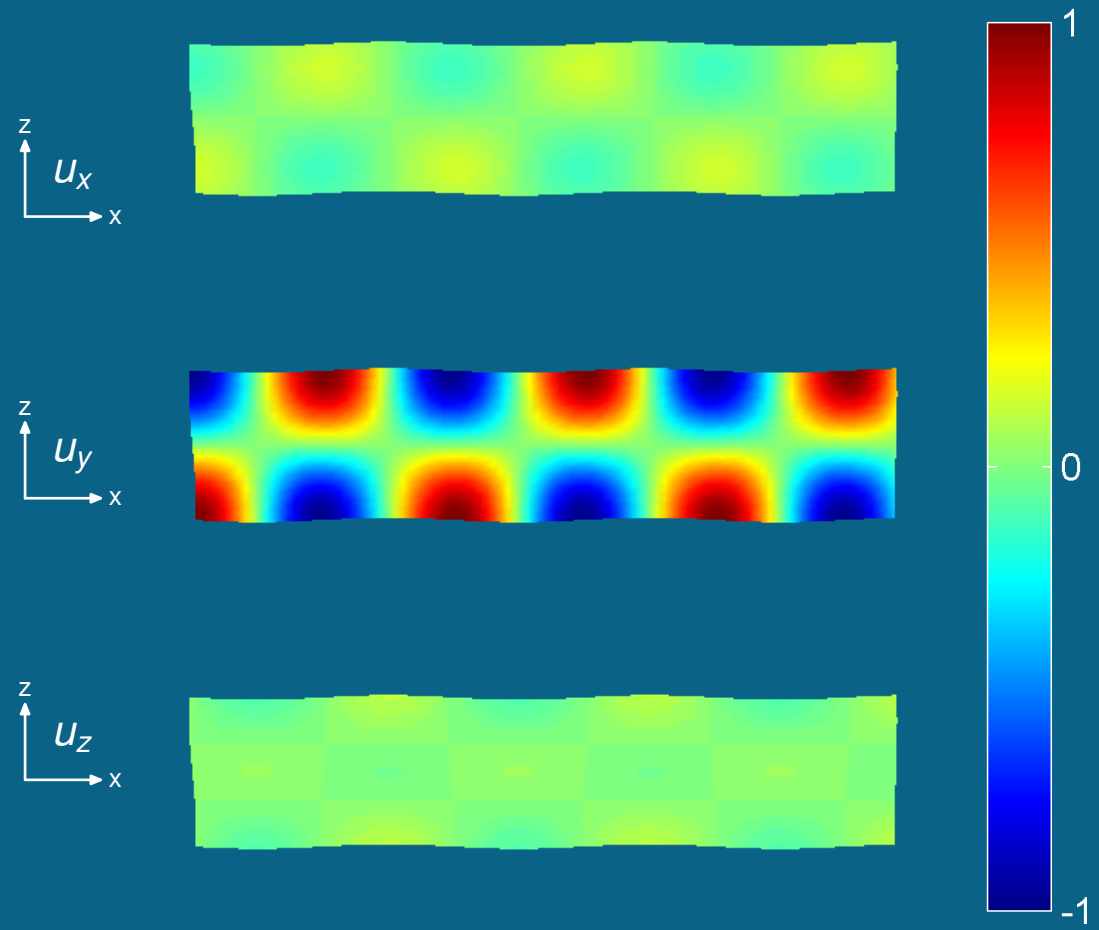
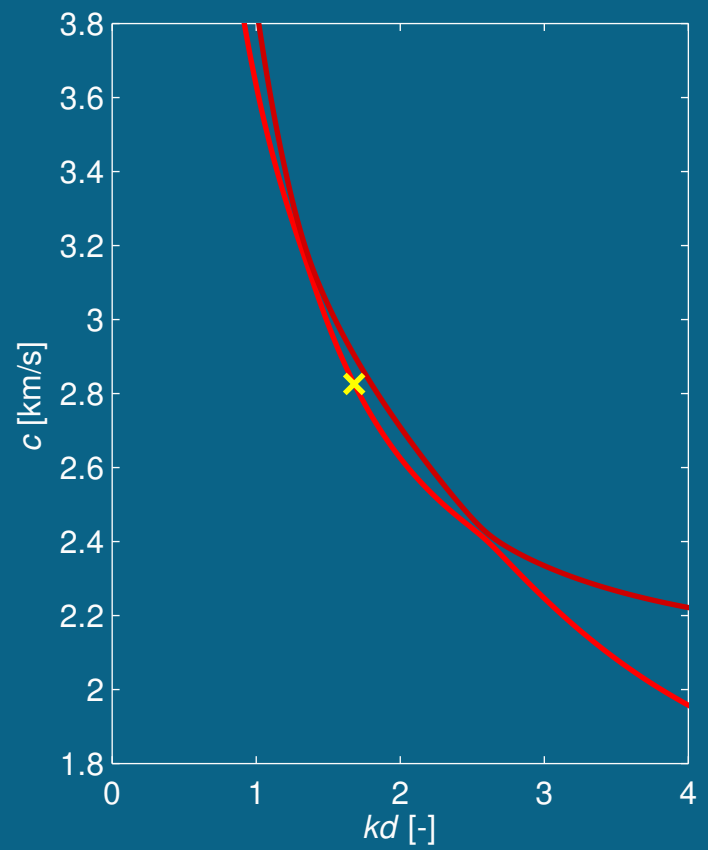
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.76$



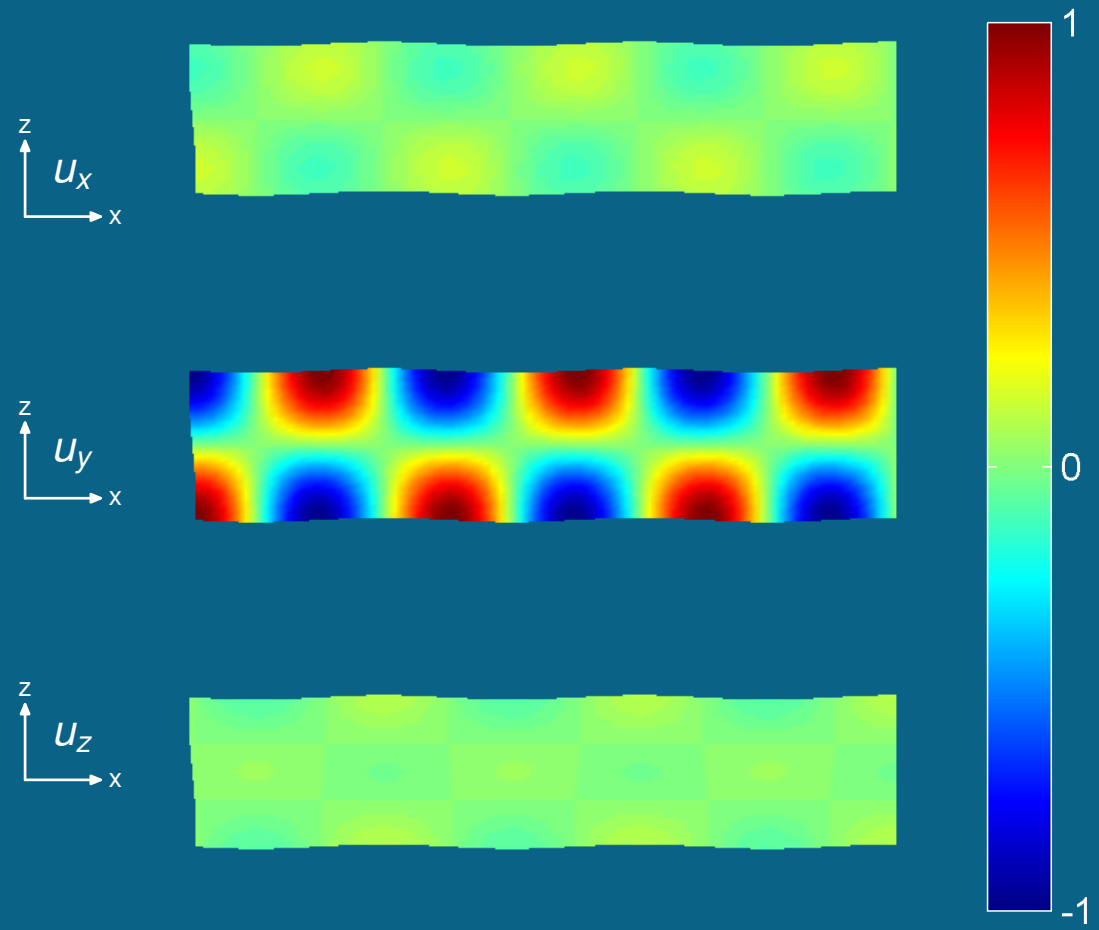
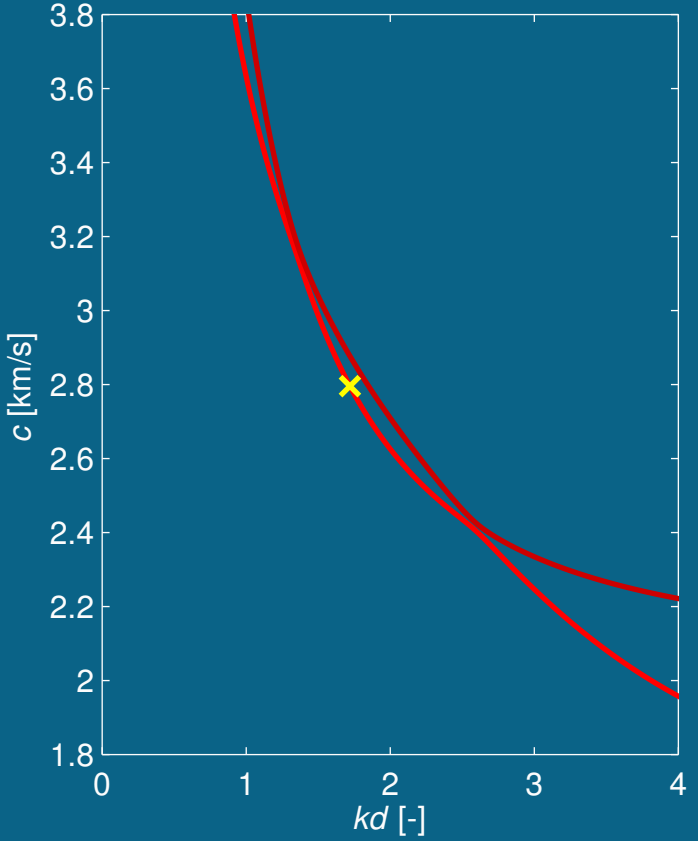
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.80$



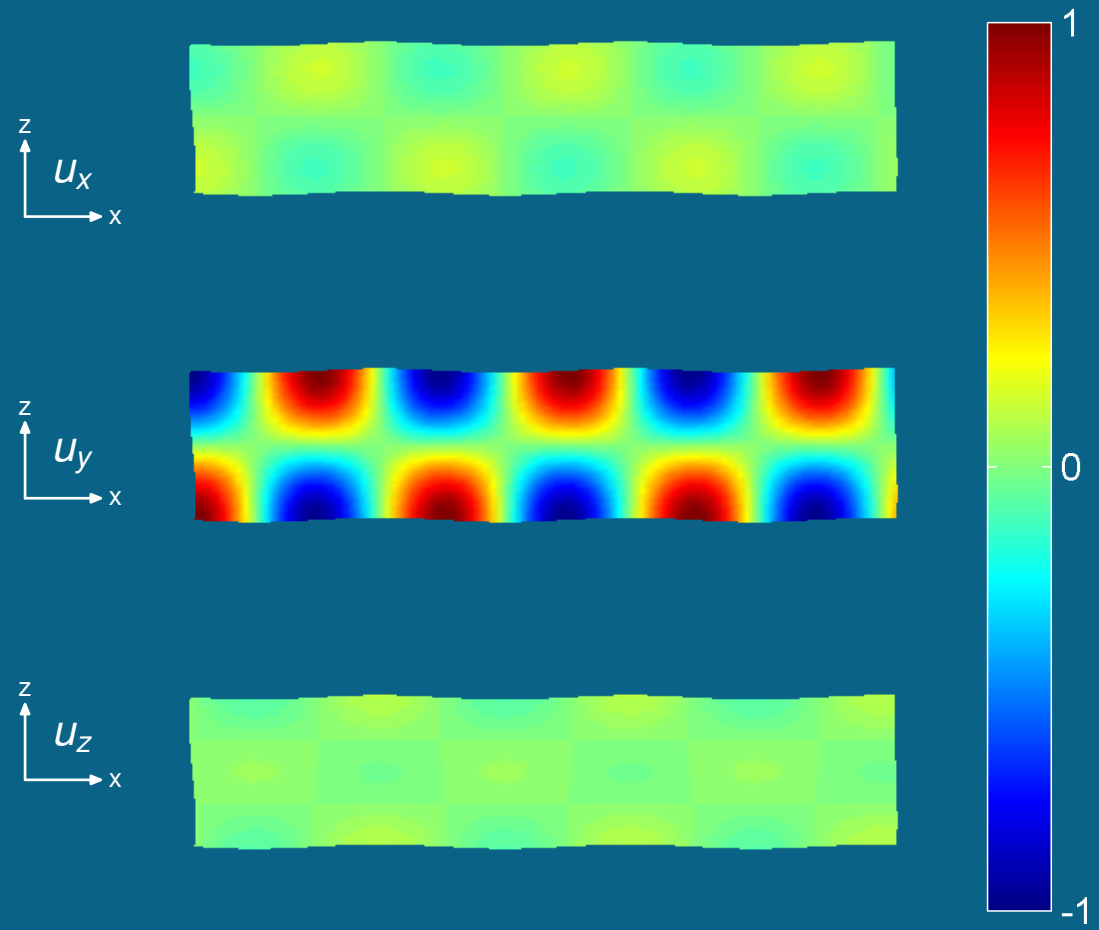
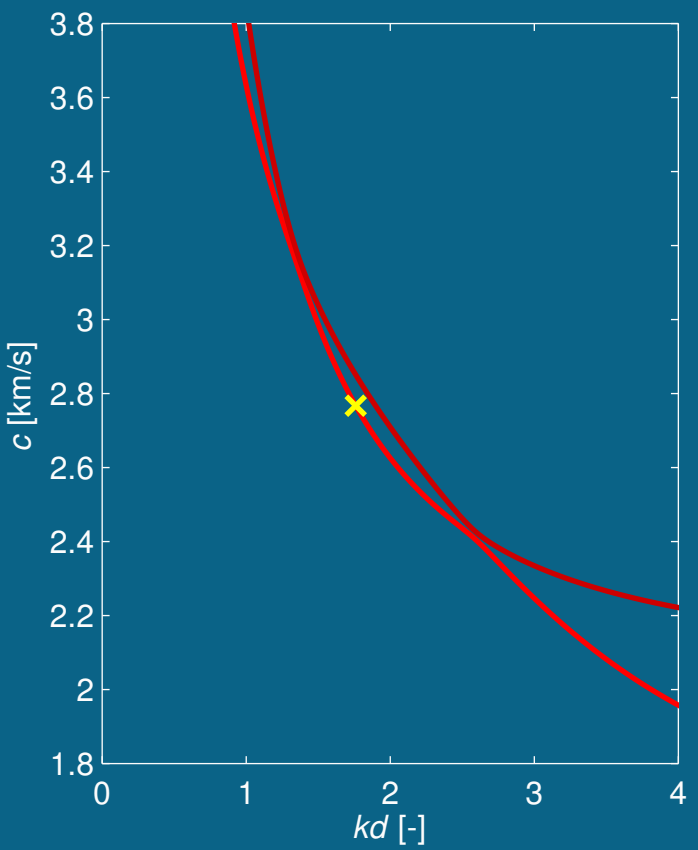
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.84$



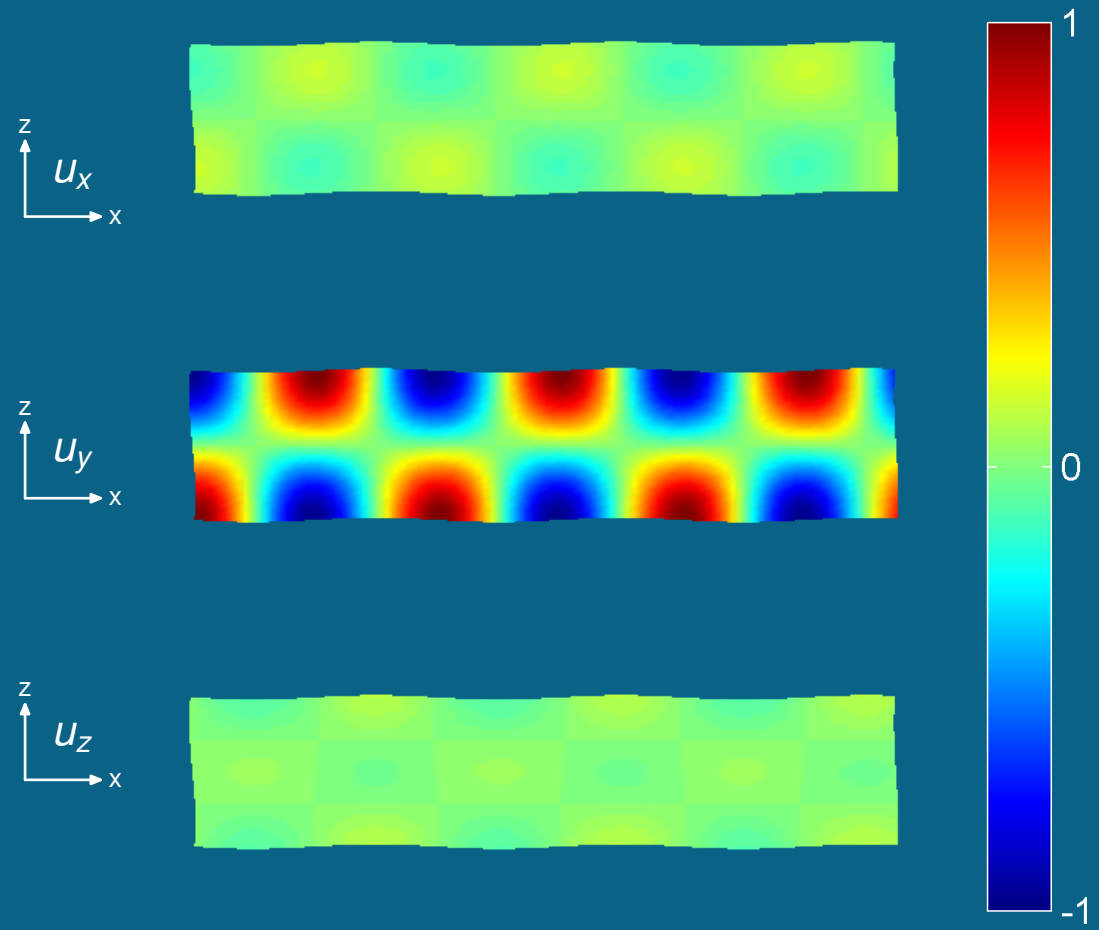
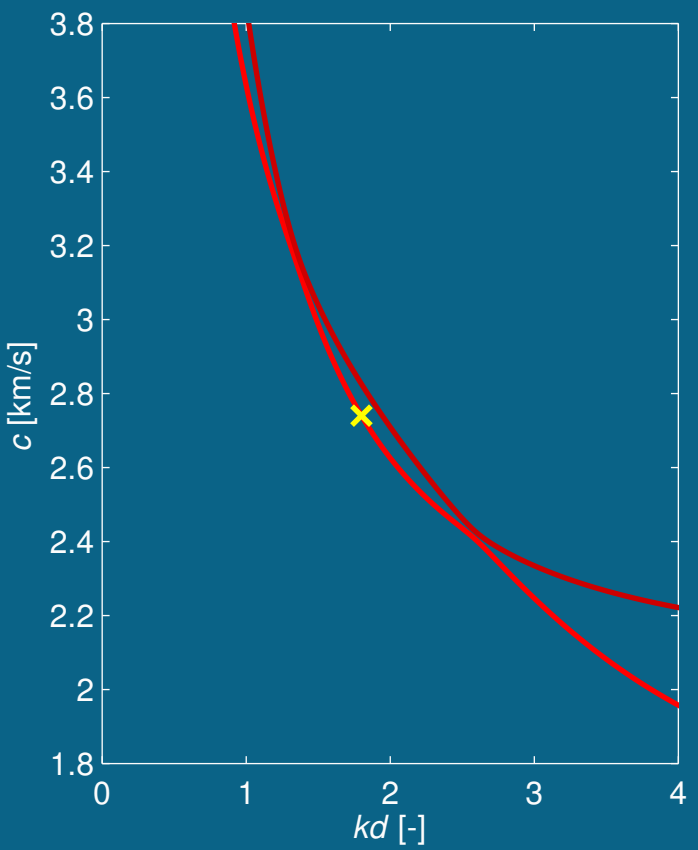
Výchyłky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.88$



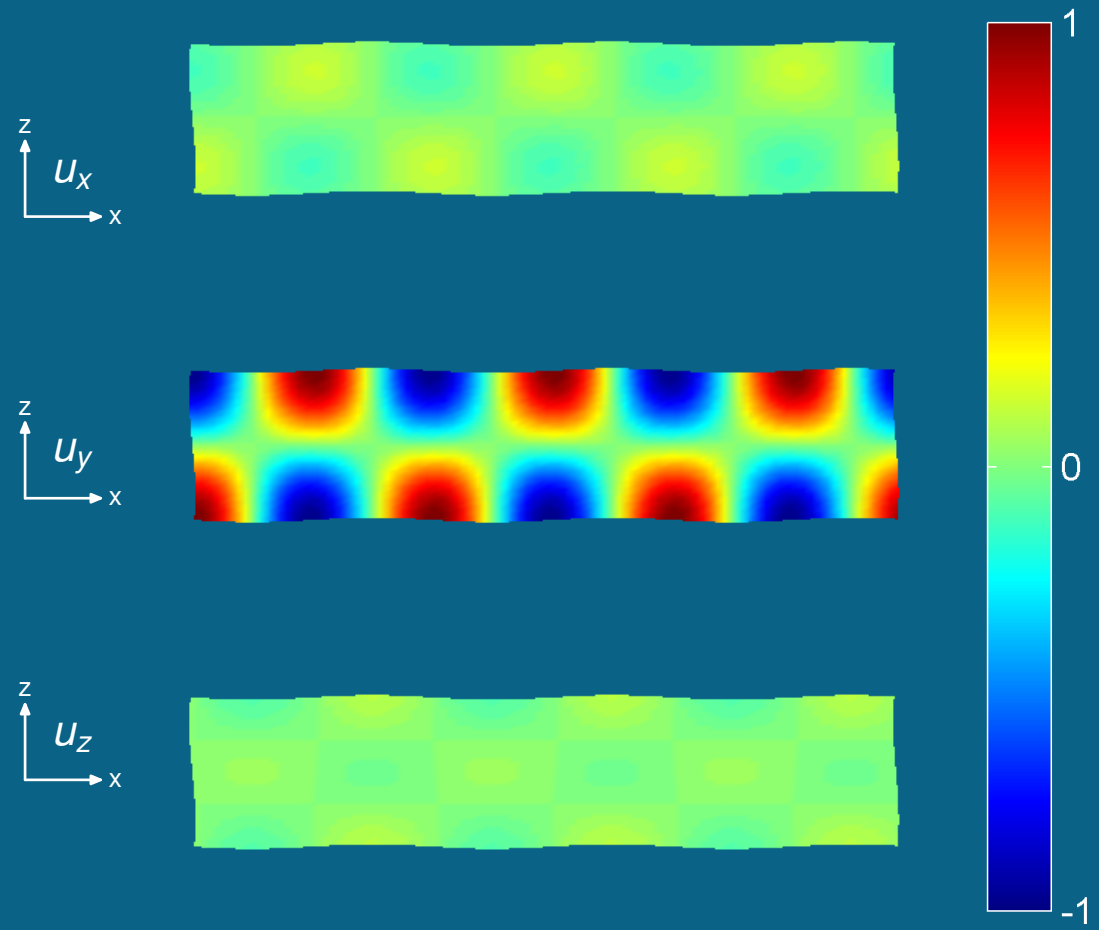
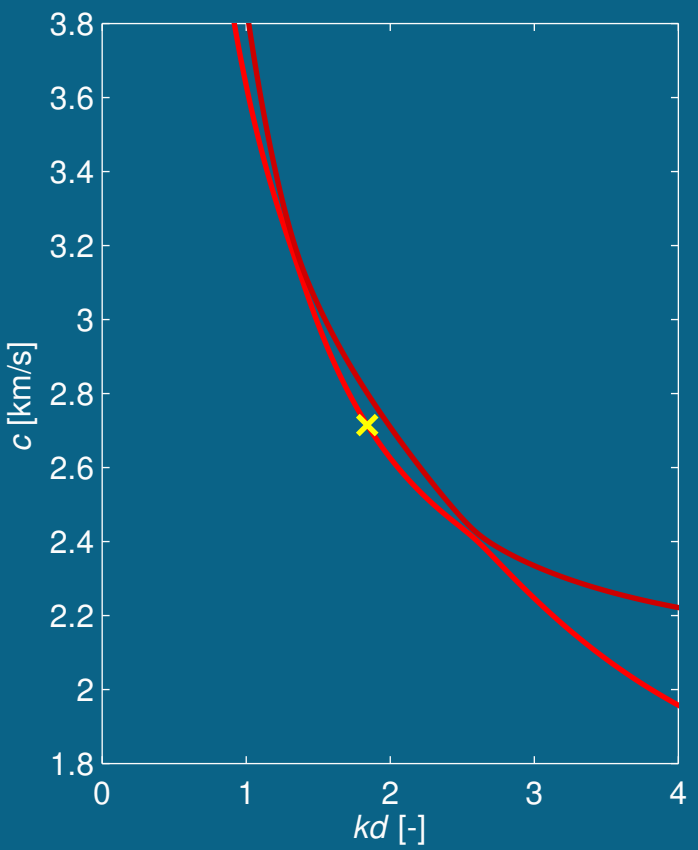
Výchyly pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.92$



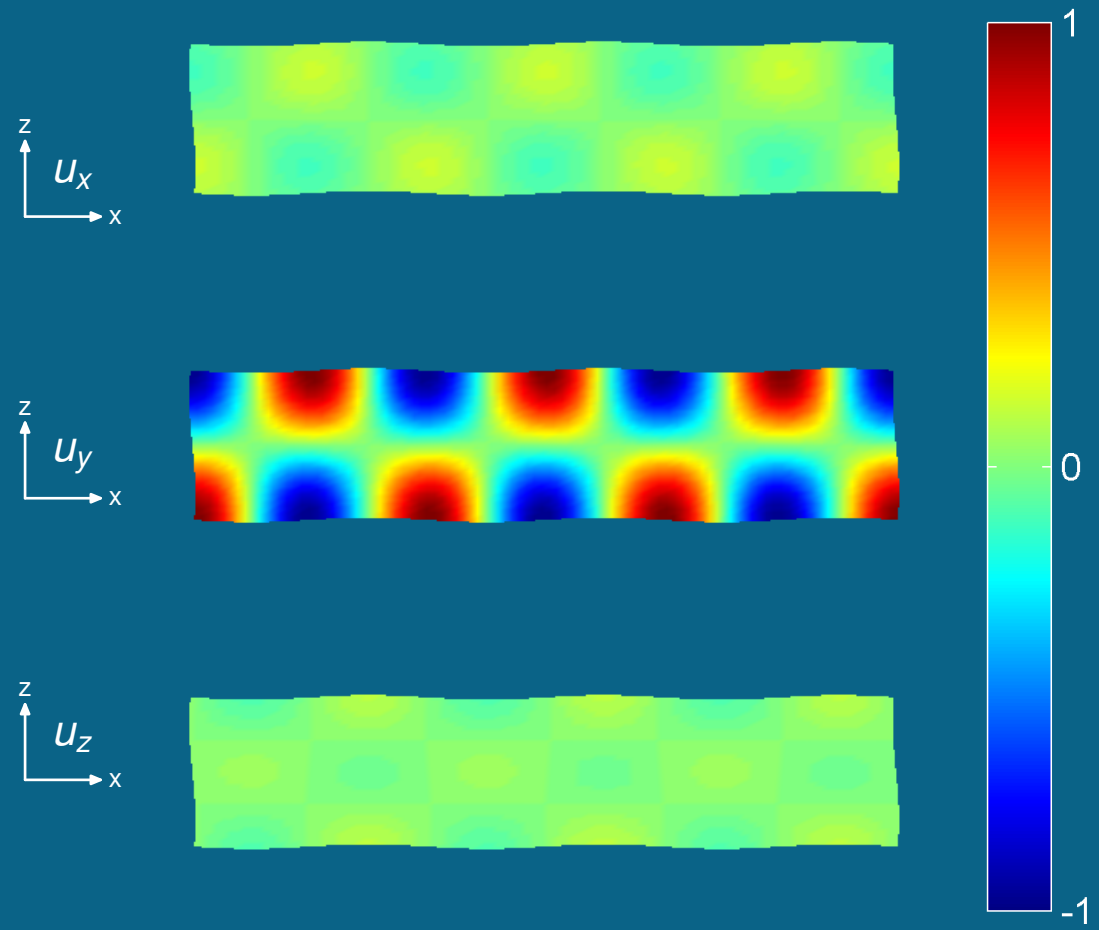
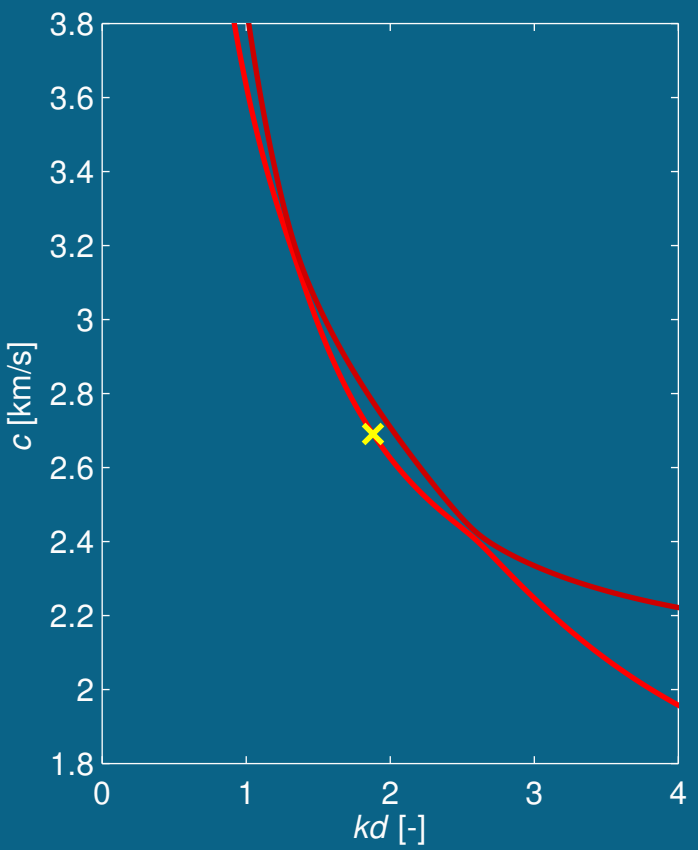
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=1.96$



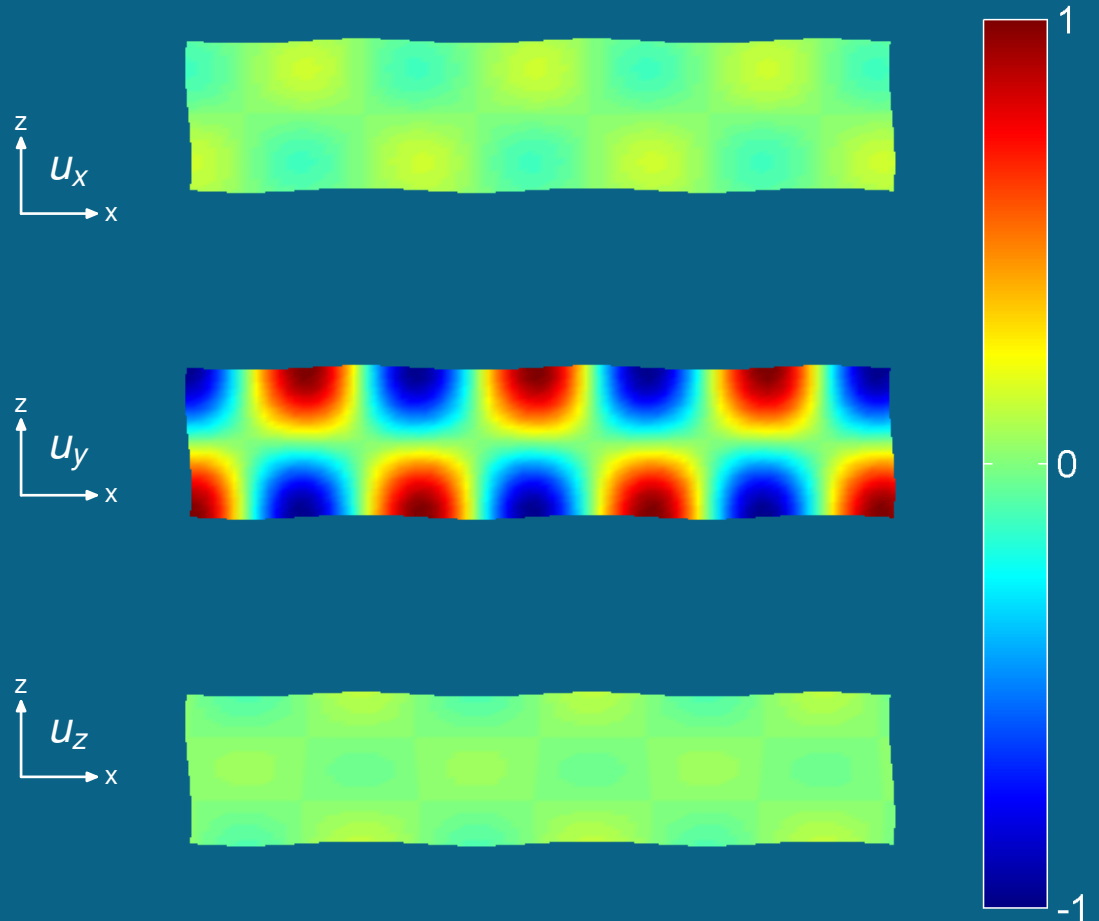
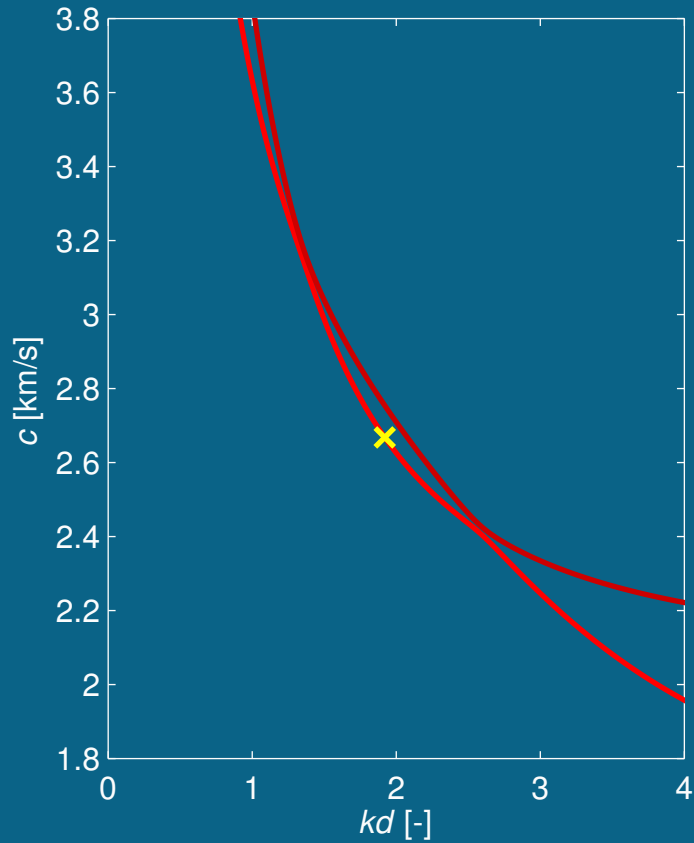
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.00$



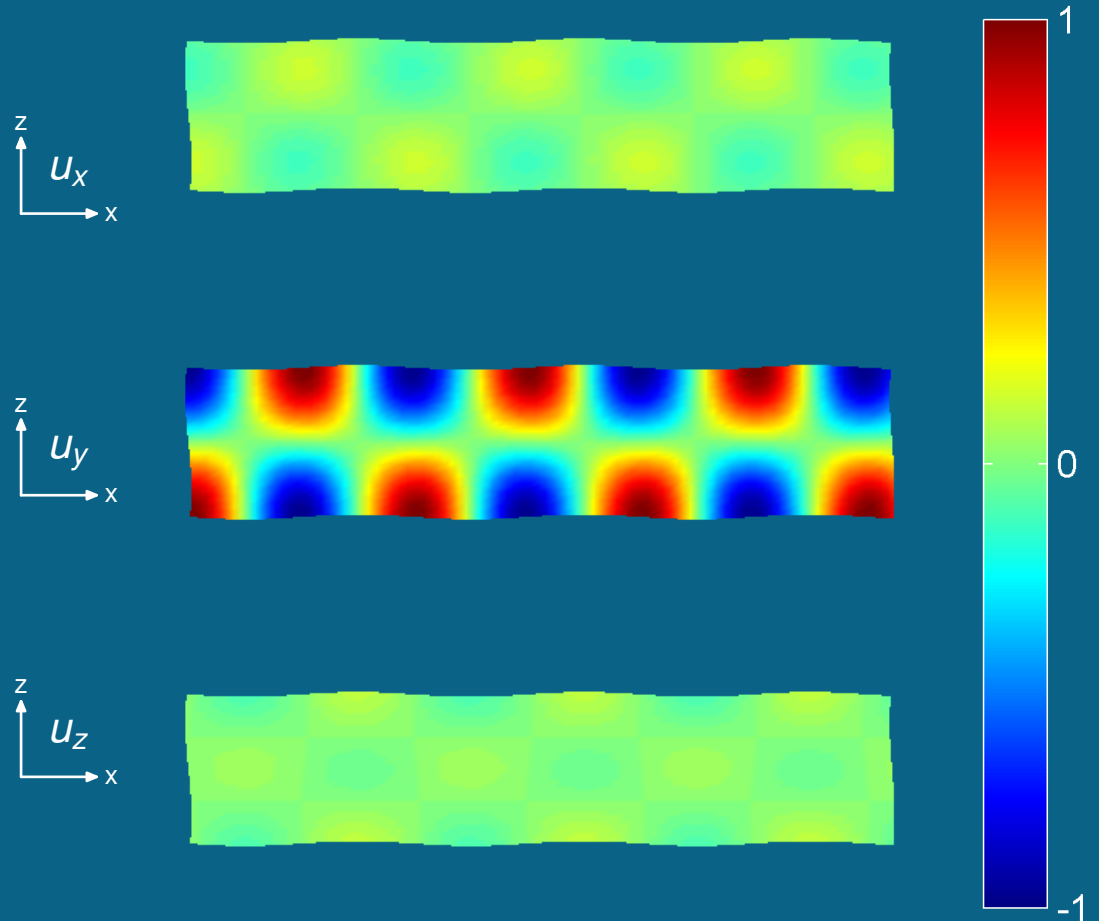
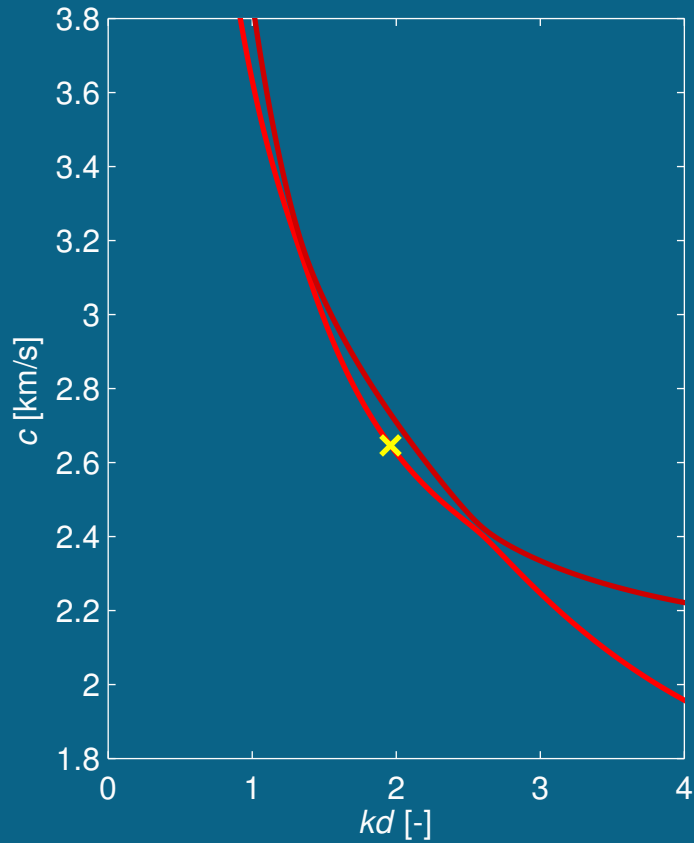
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.04$



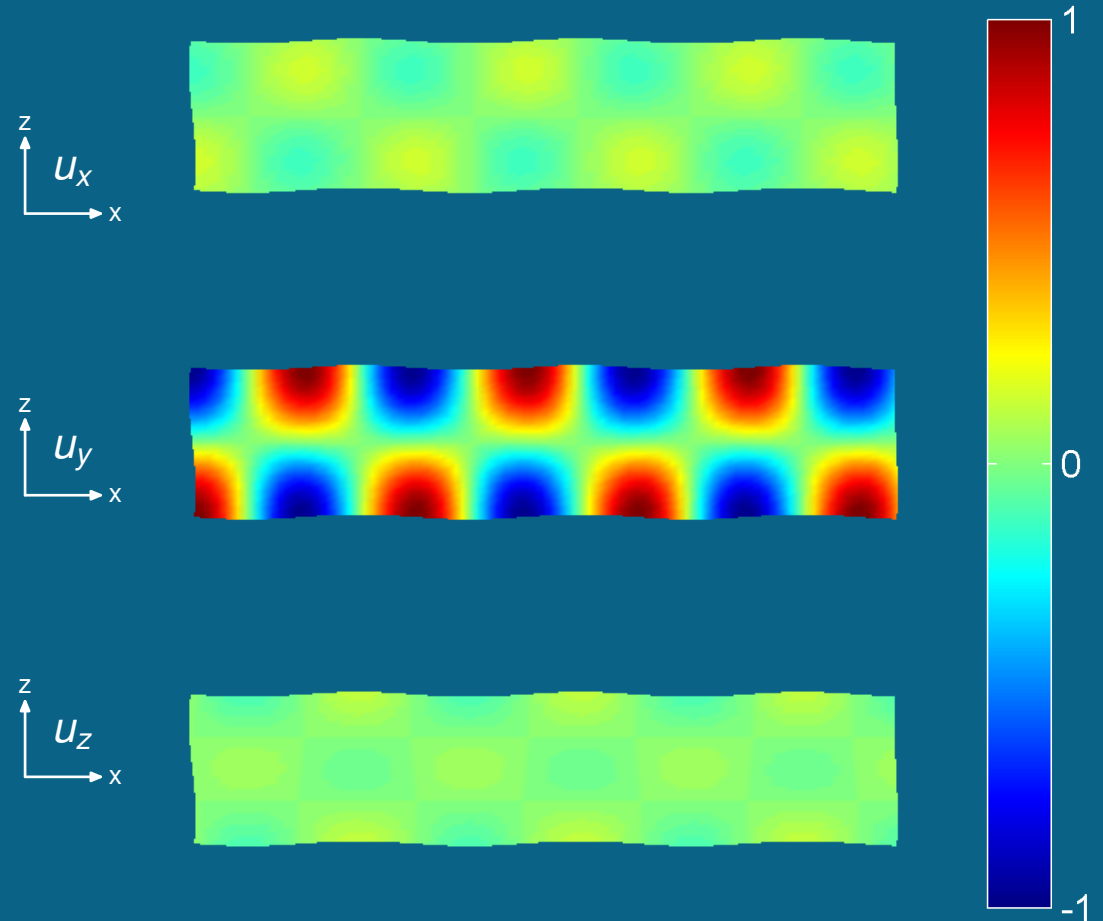
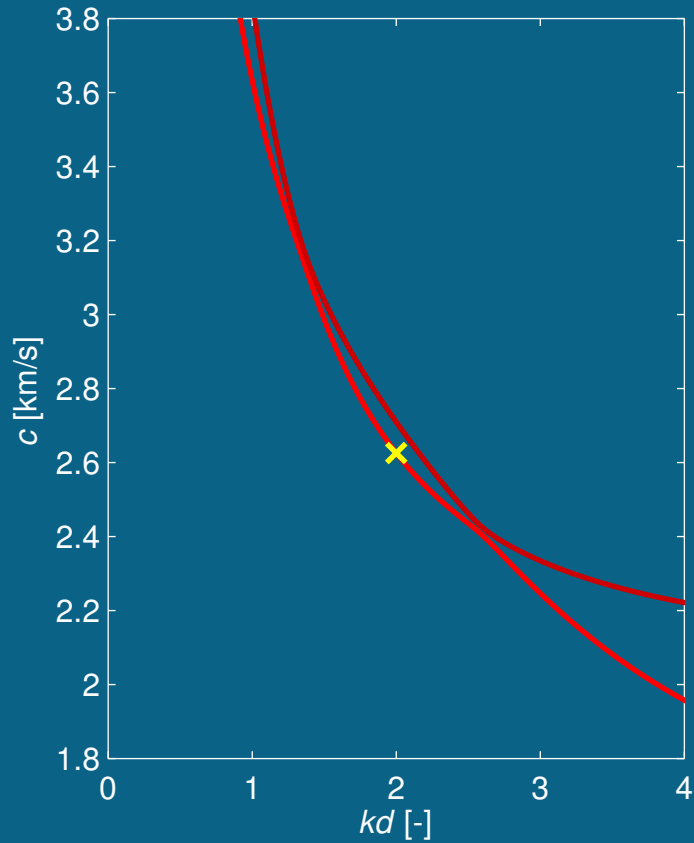
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.08$



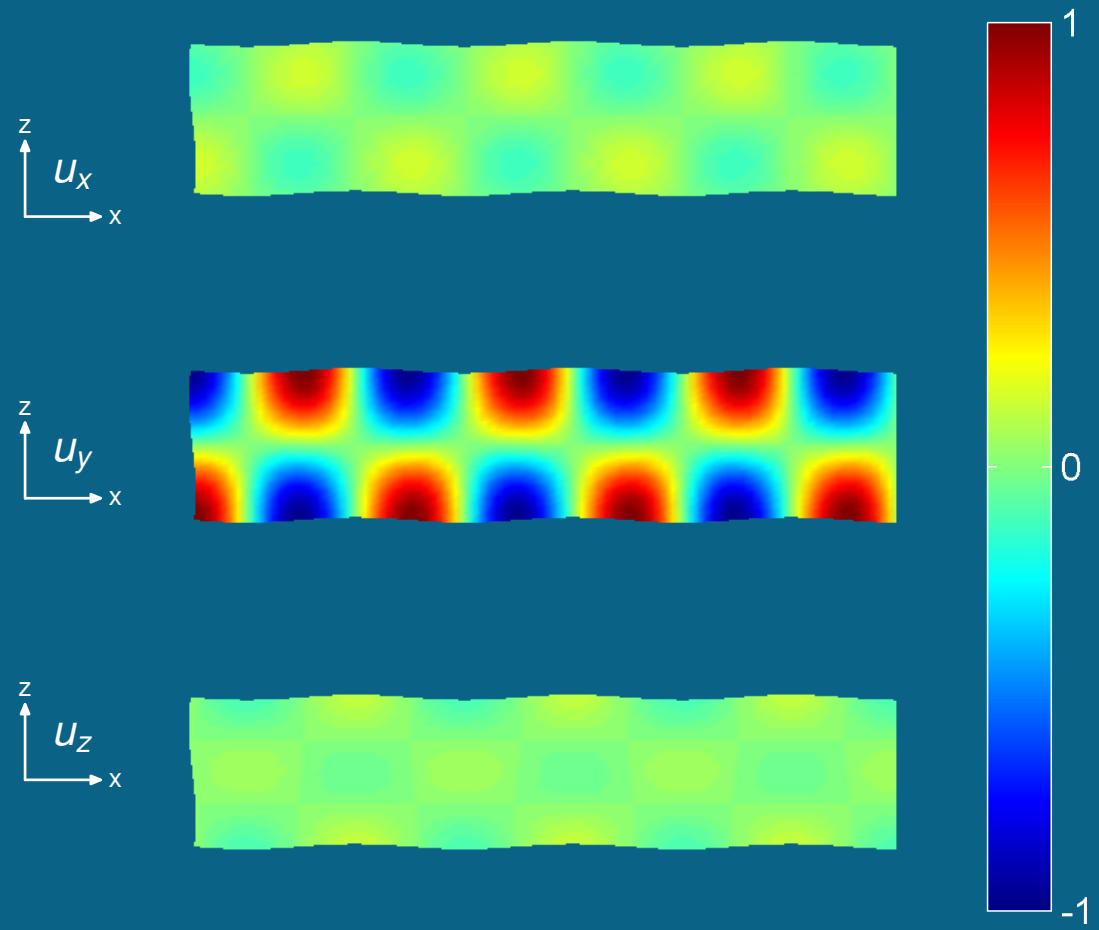
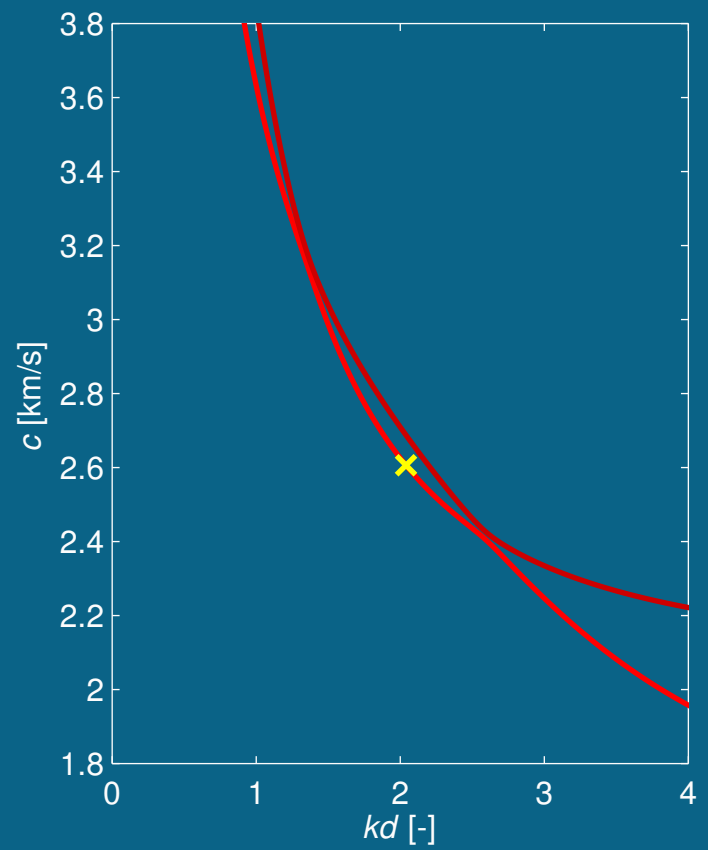
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.12$



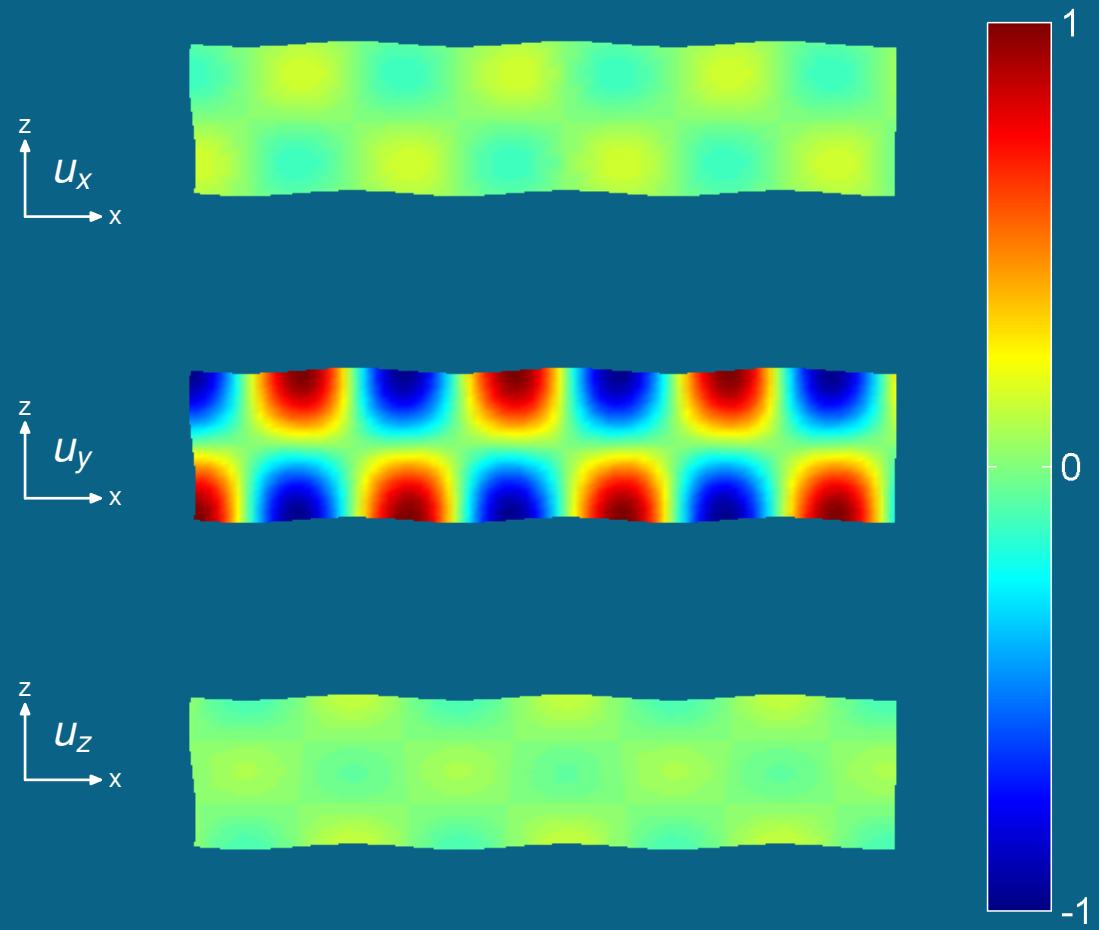
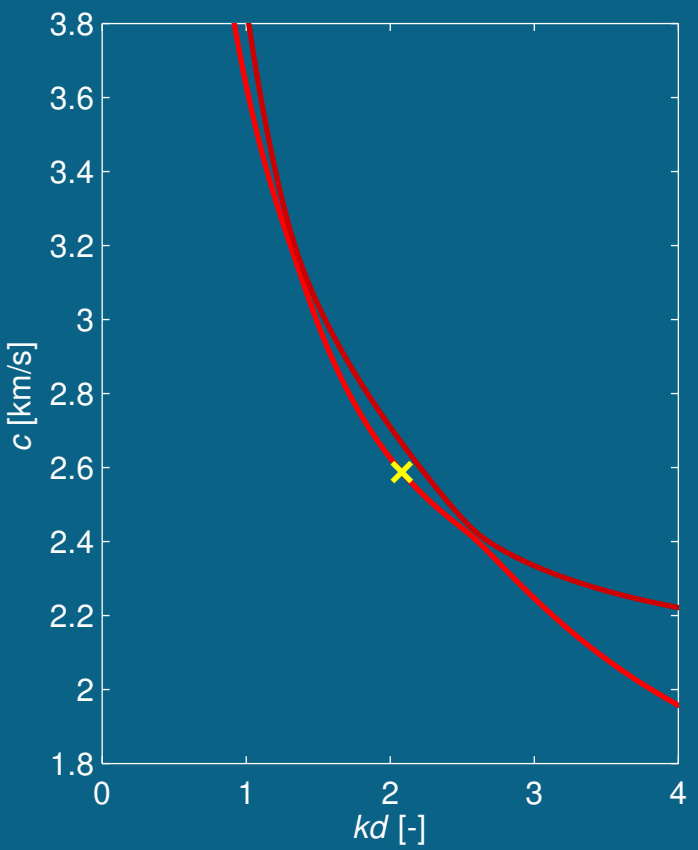
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.16$



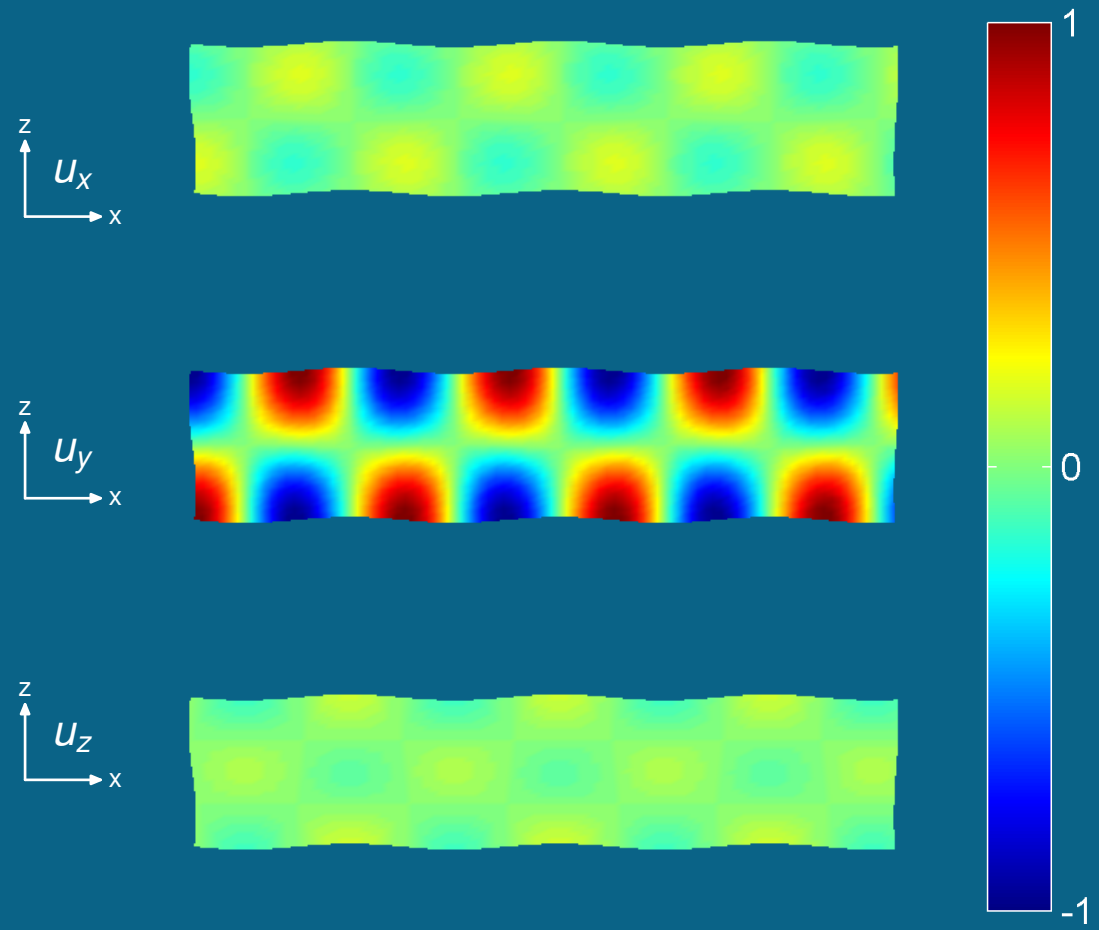
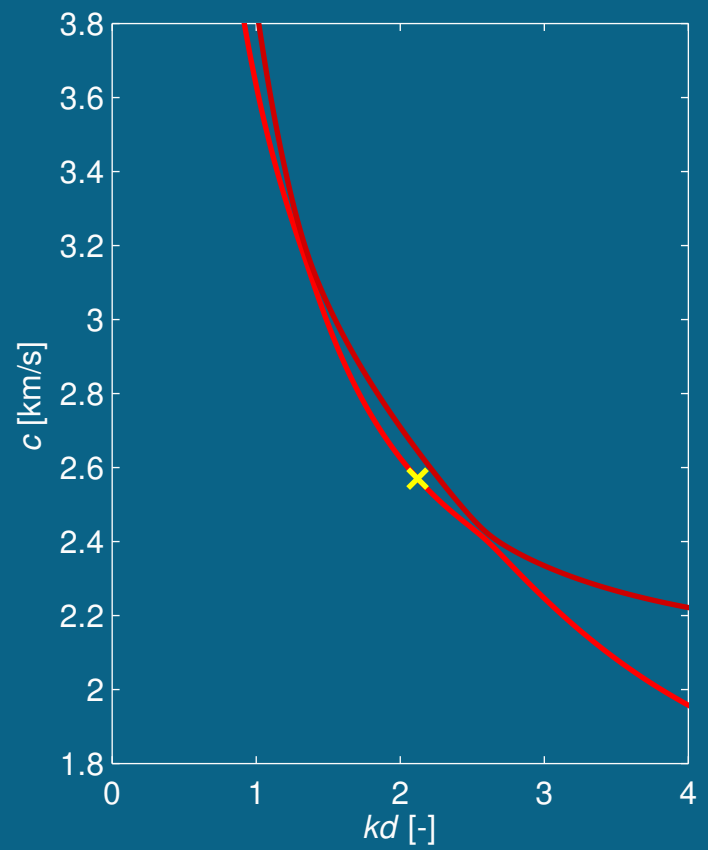
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.20$



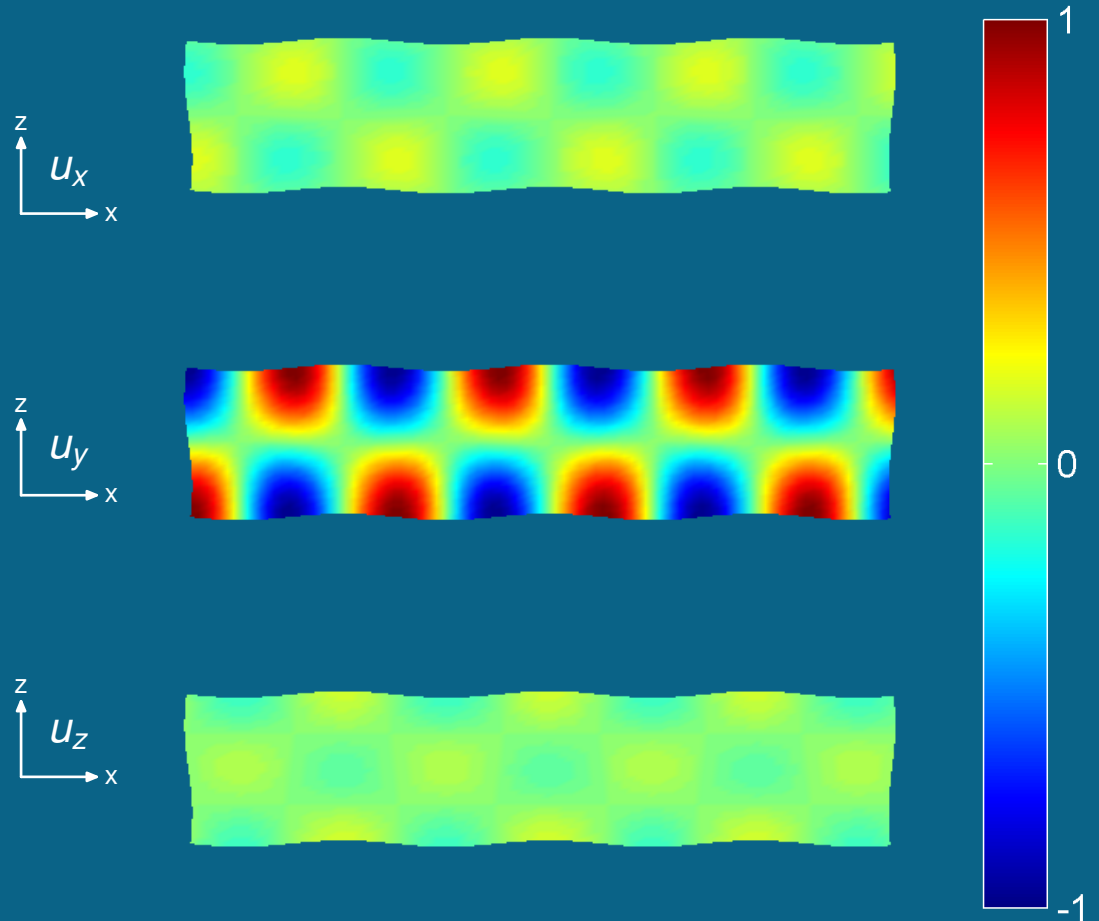
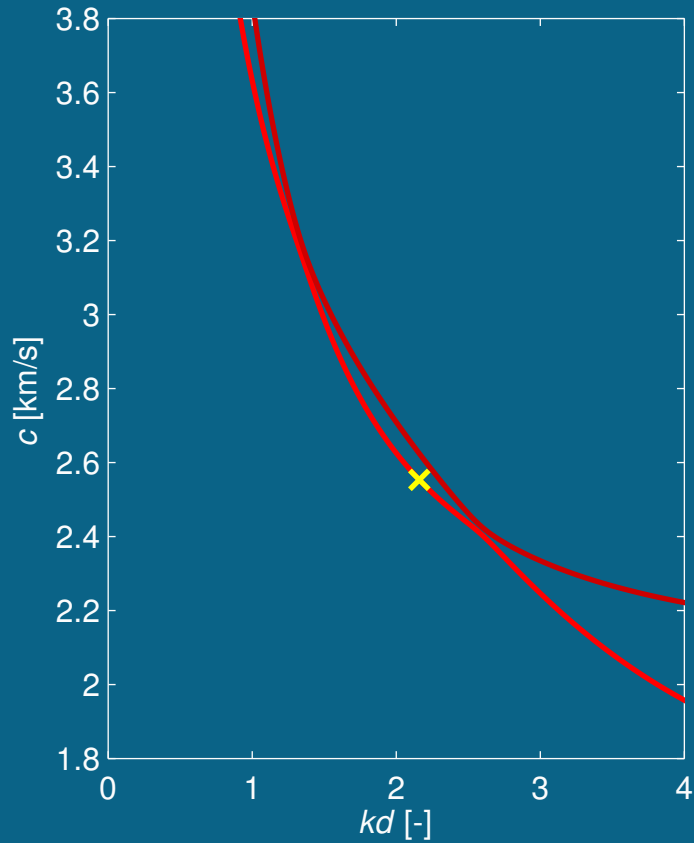
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.24$



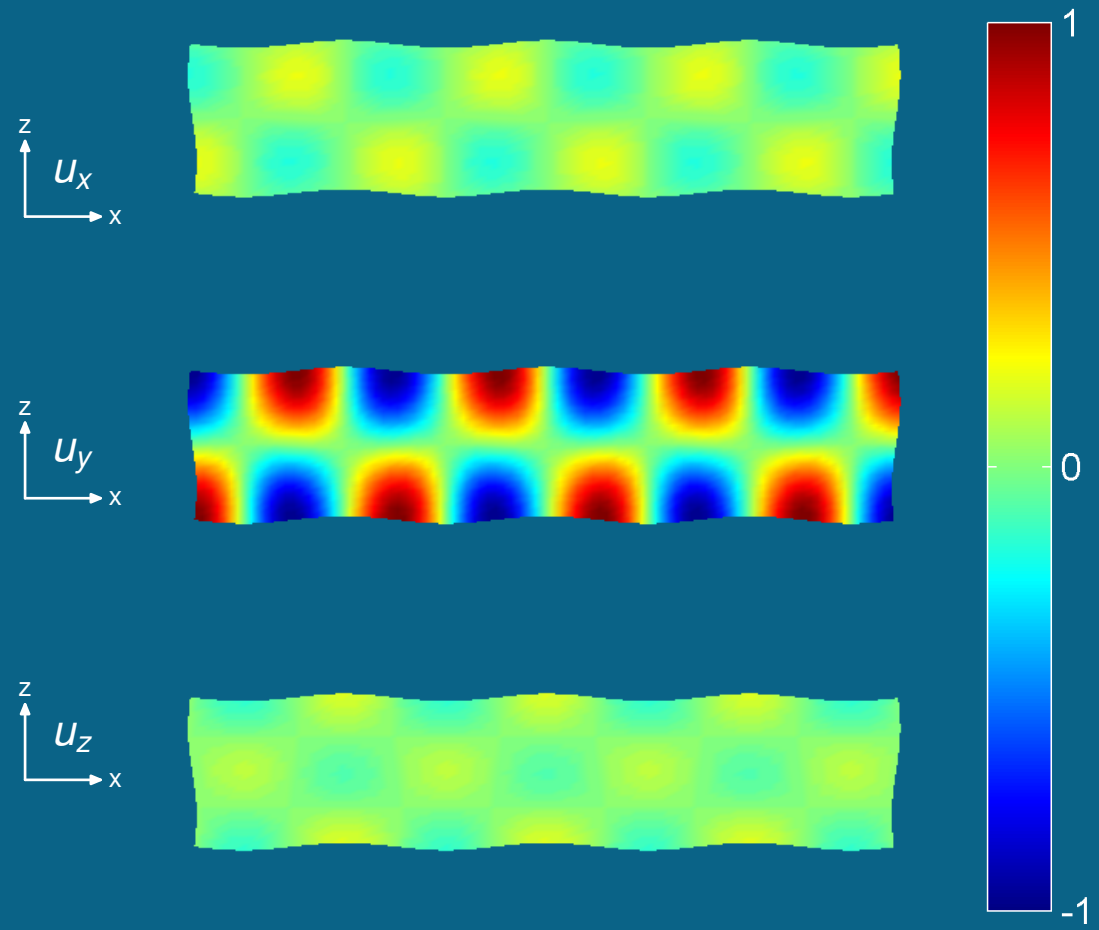
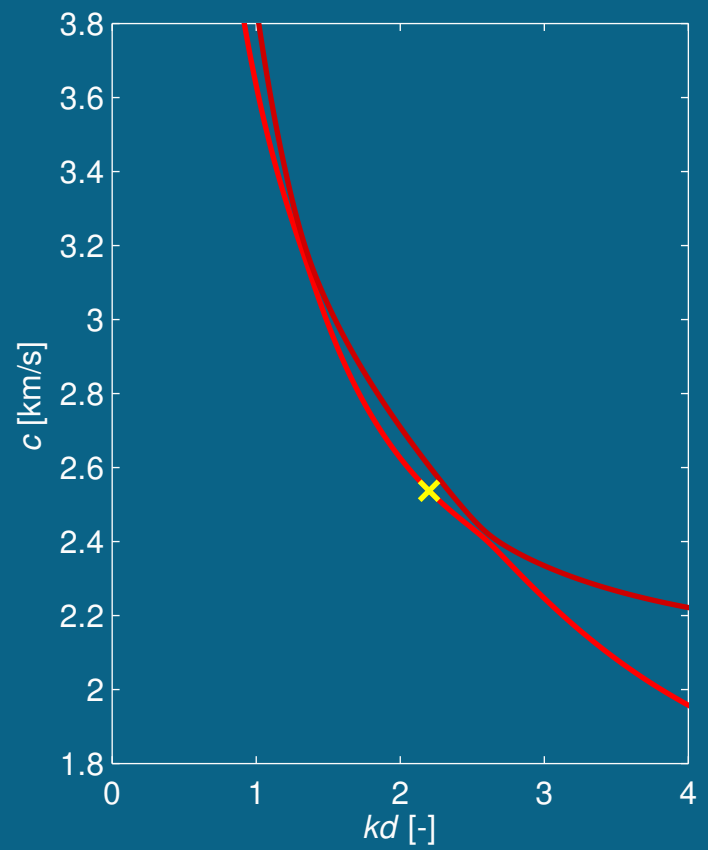
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.28$



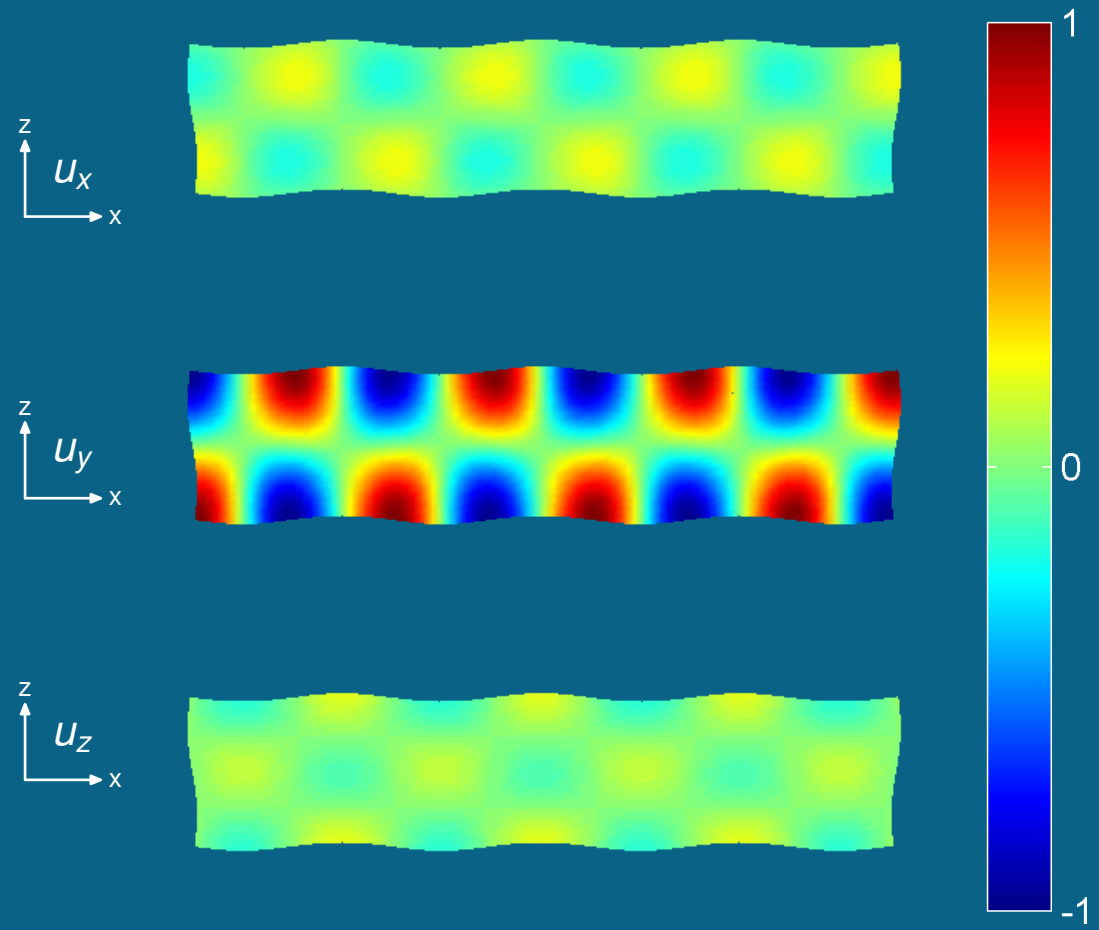
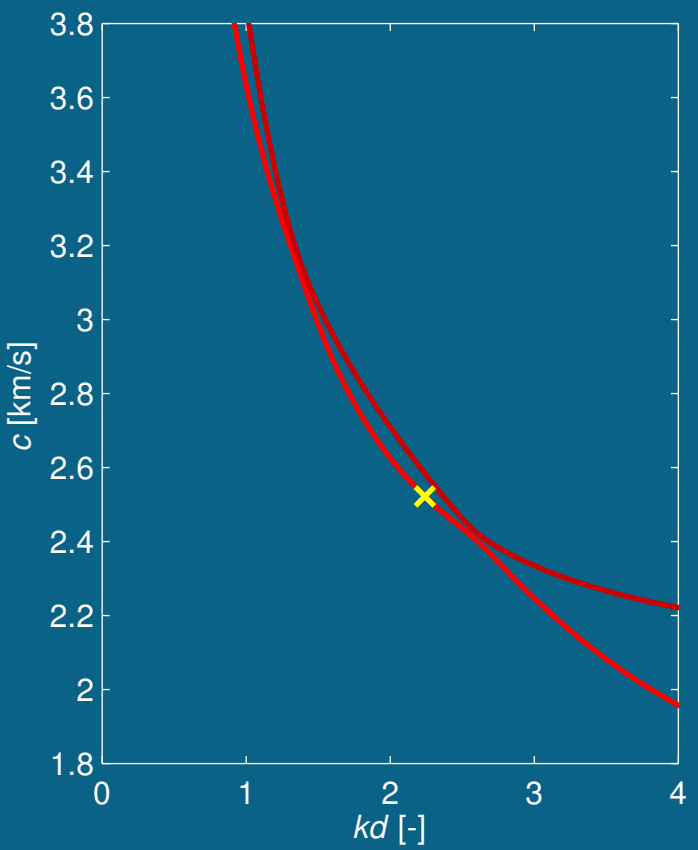
Výchyly pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.32$



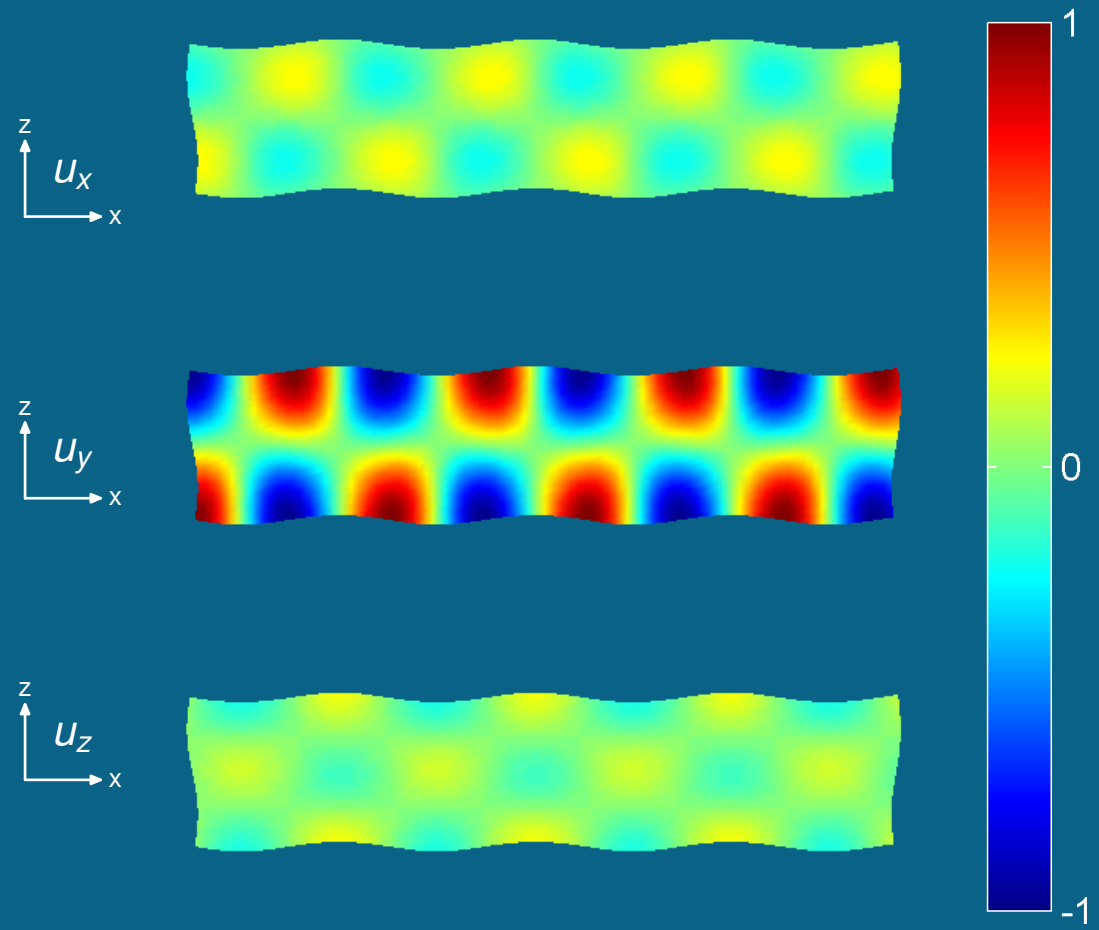
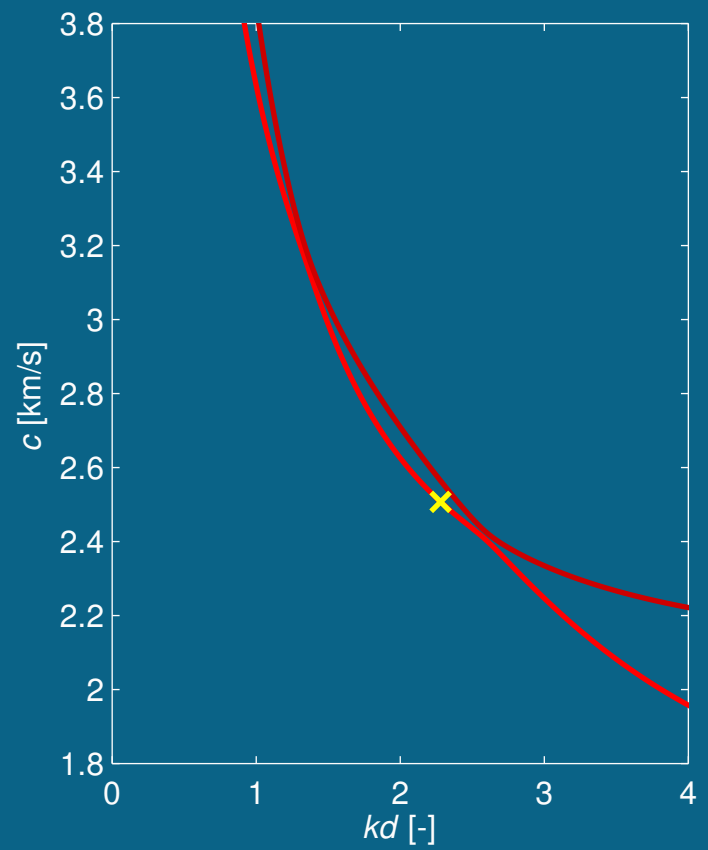
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.36$



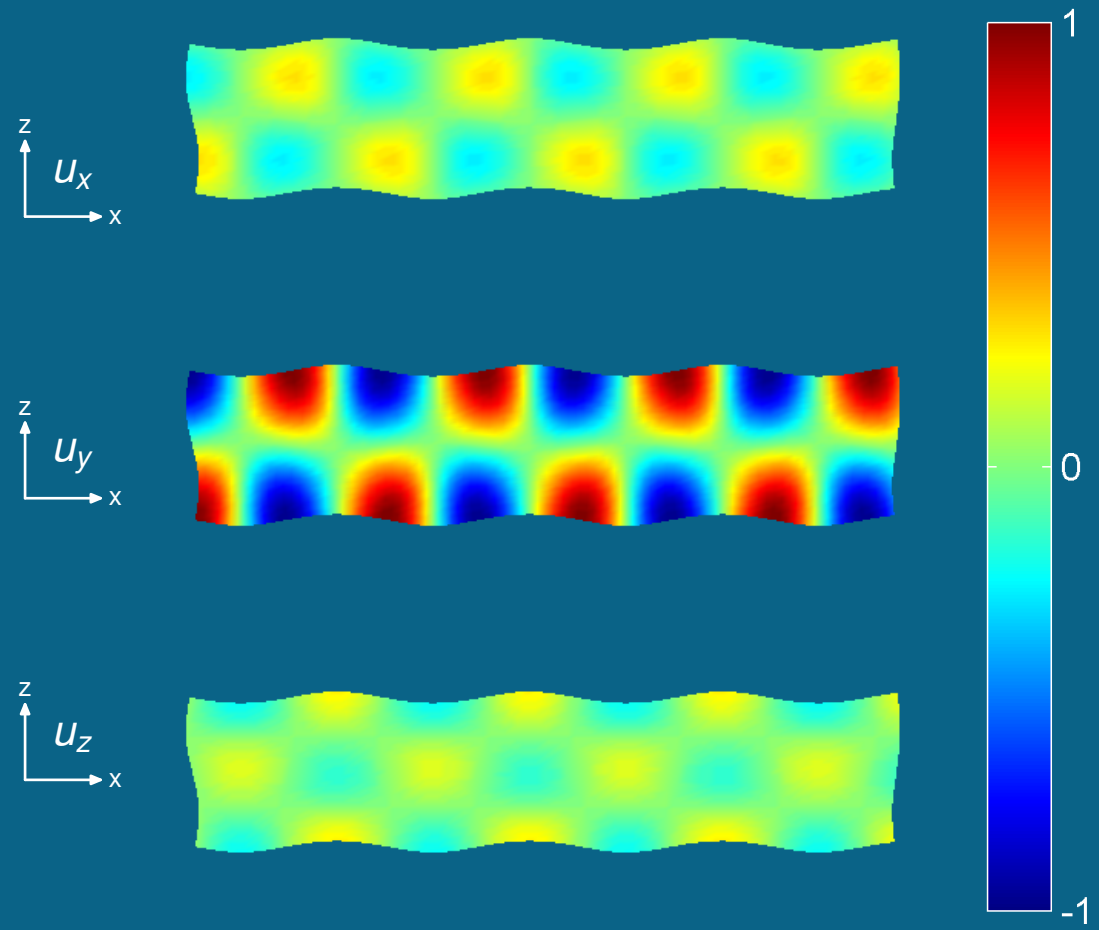
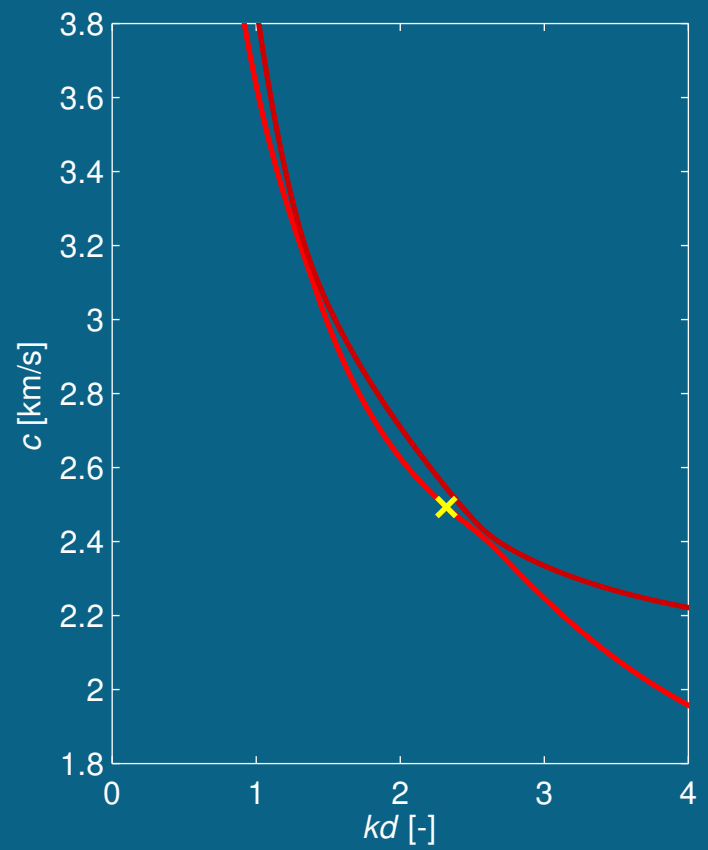
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.40$



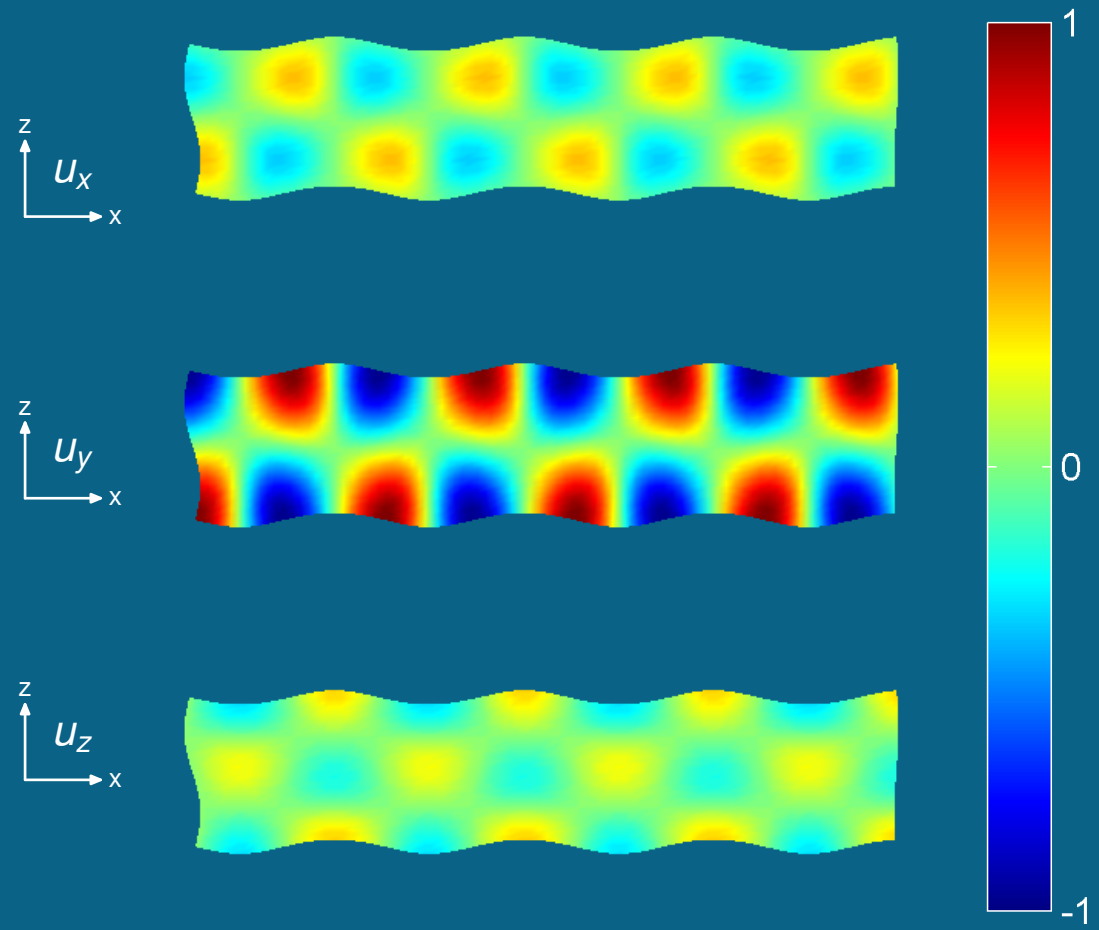
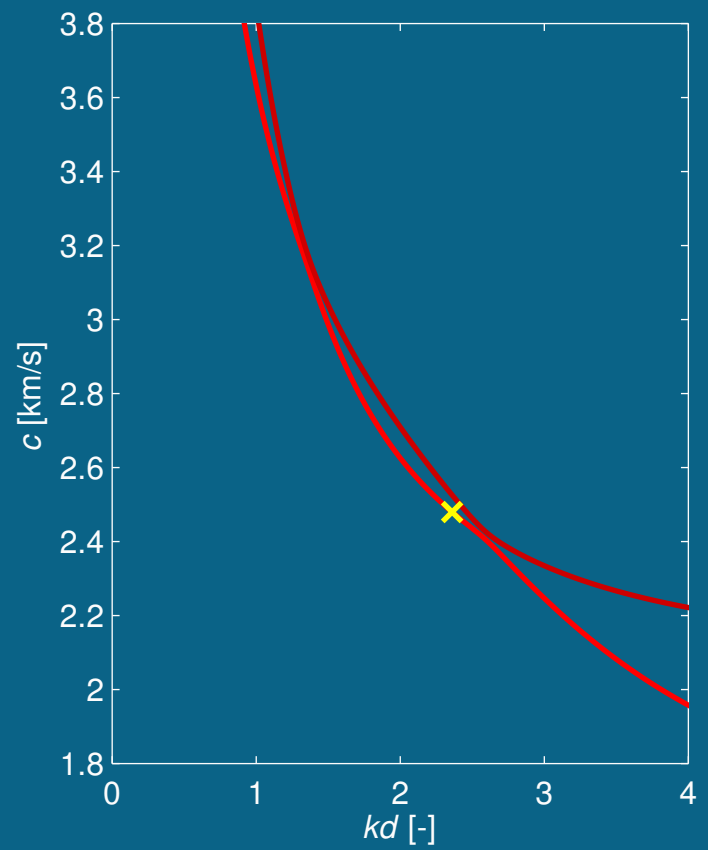
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.44$



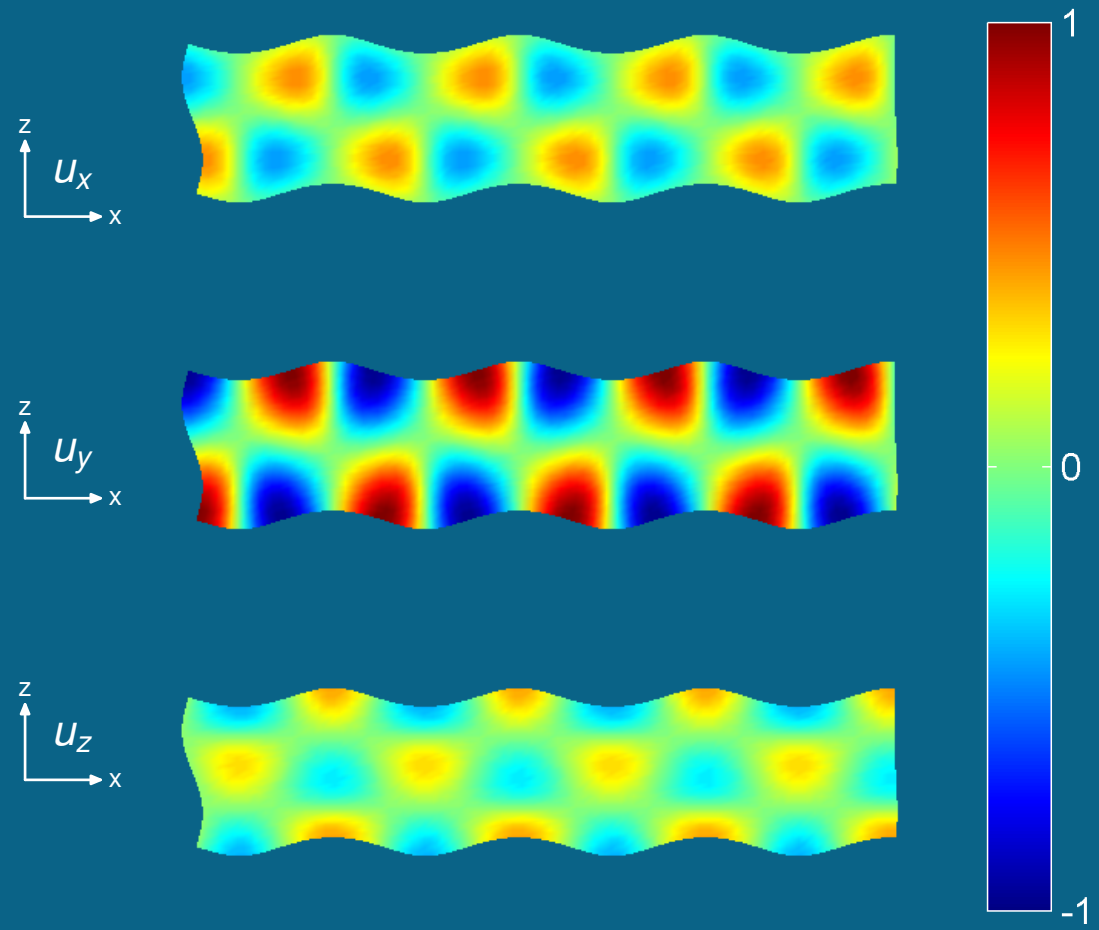
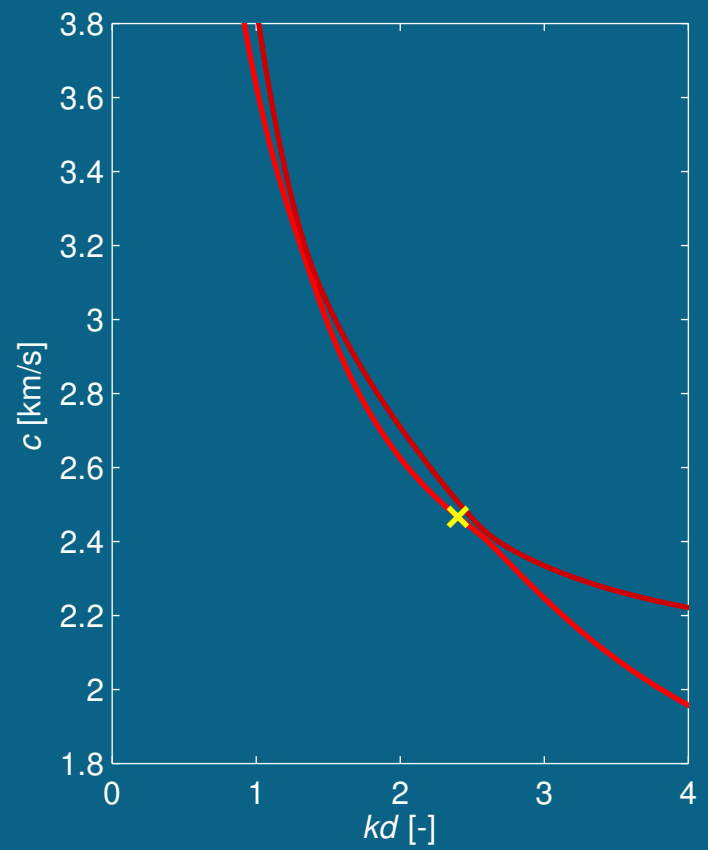
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.48$



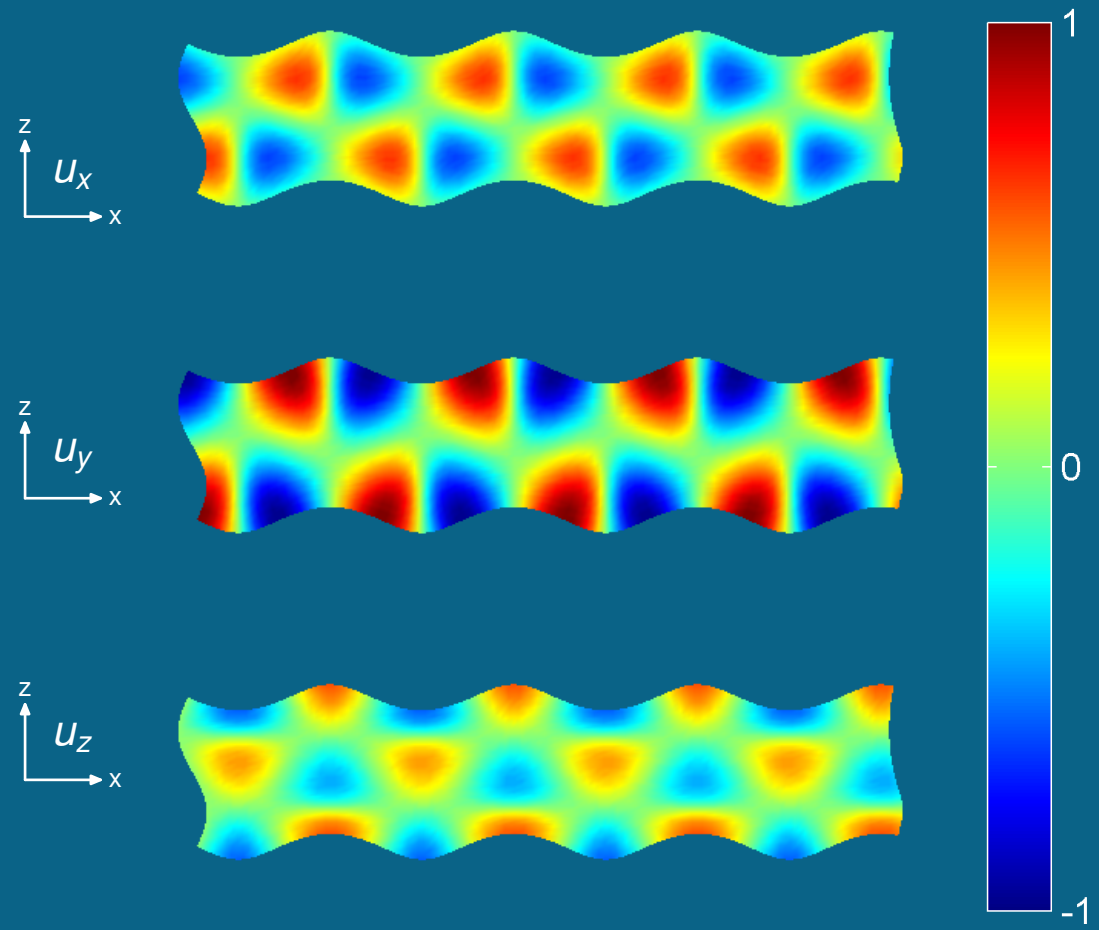
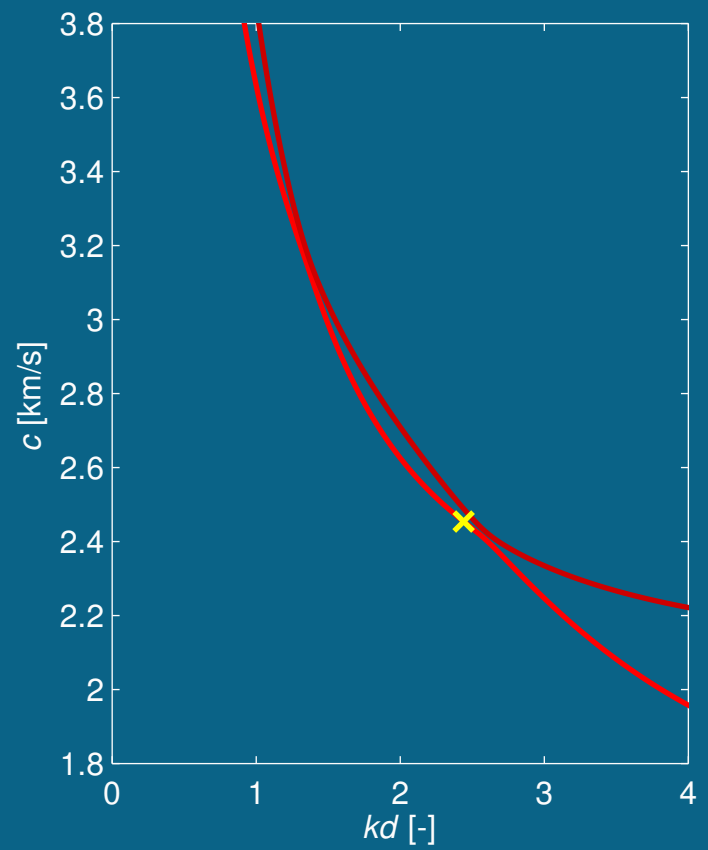
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.52$



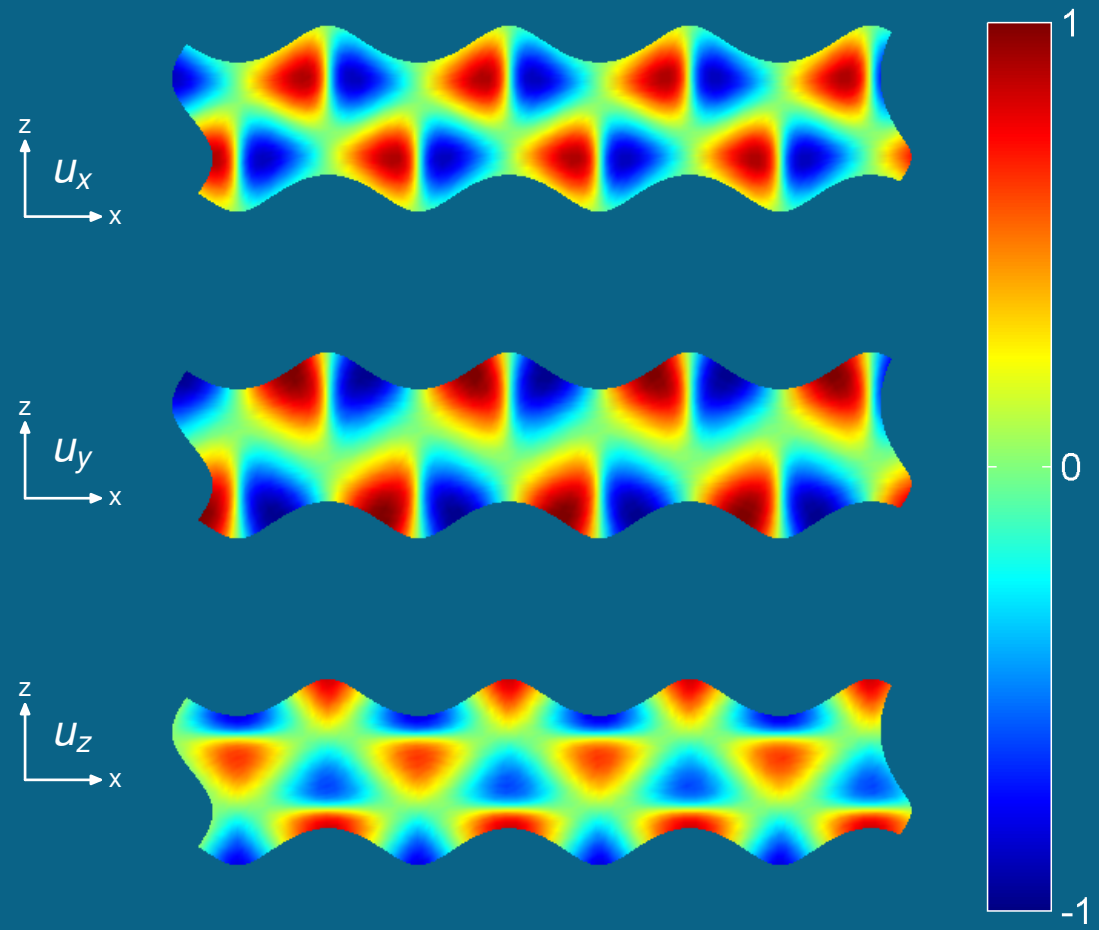
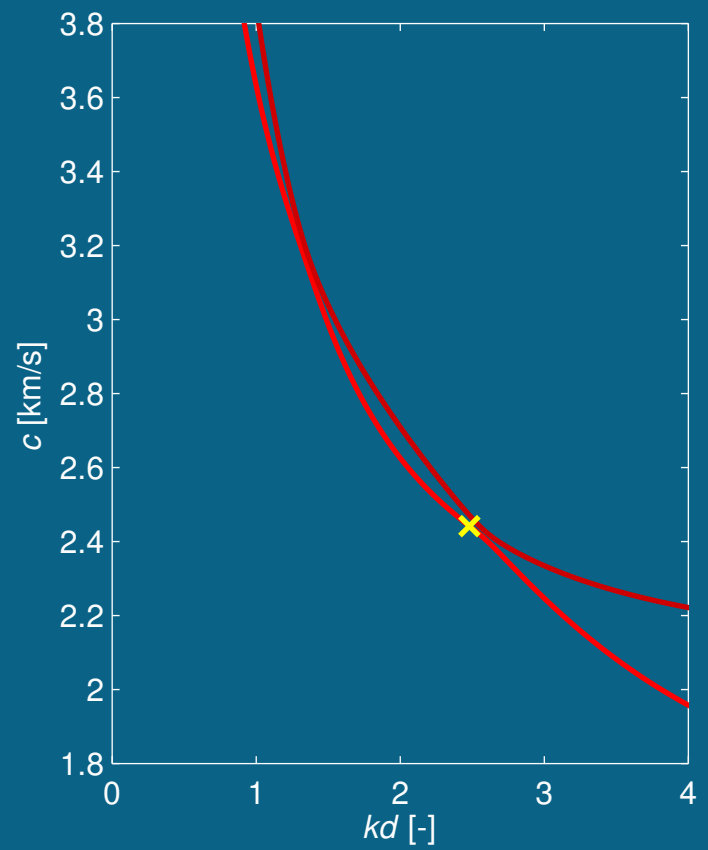
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.56$



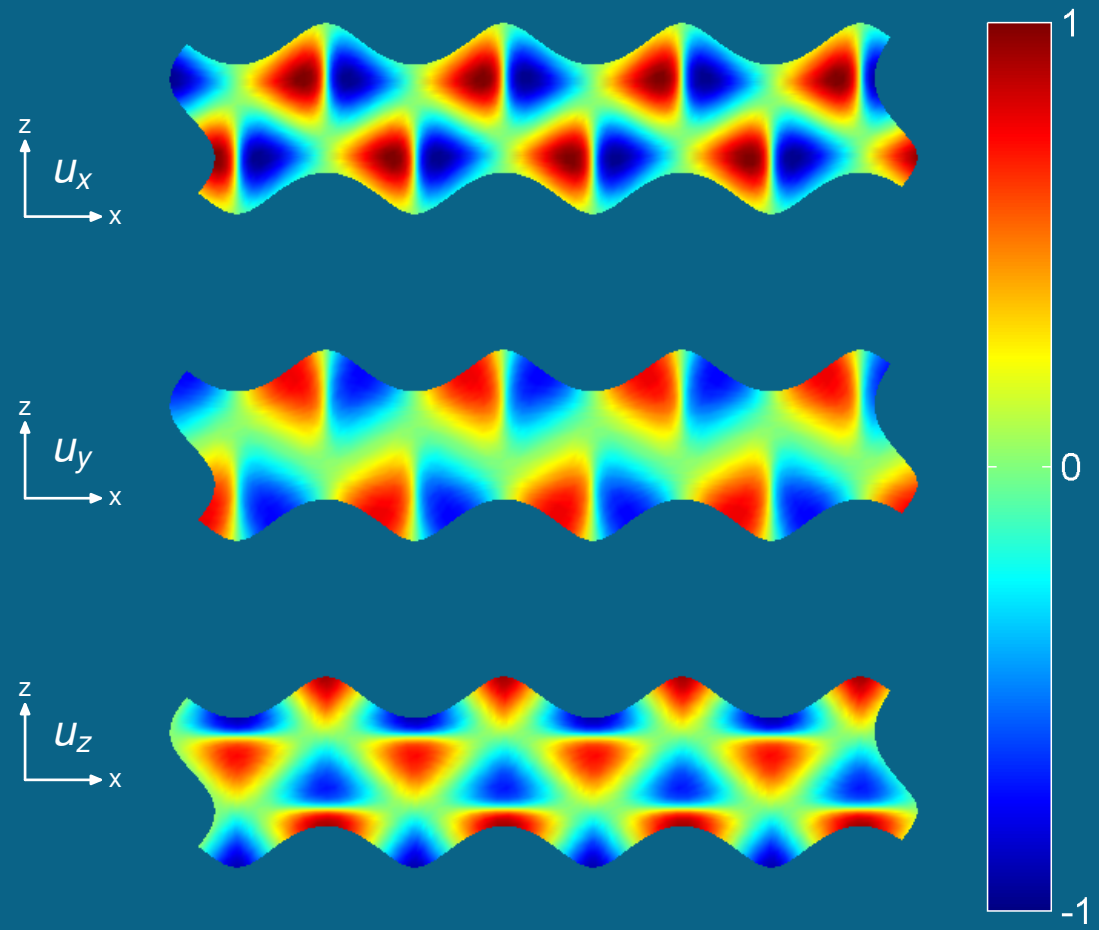
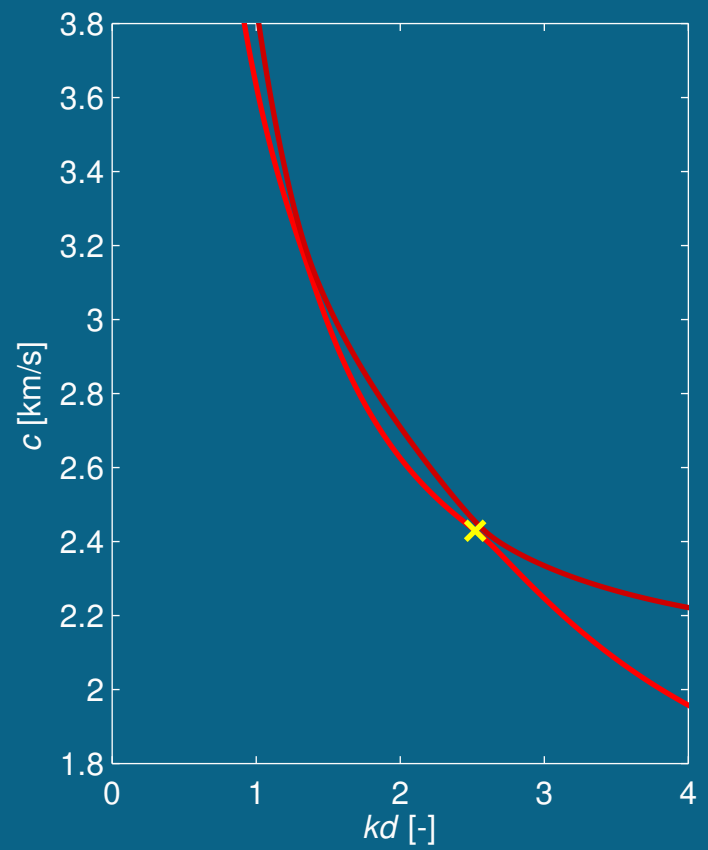
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.60$



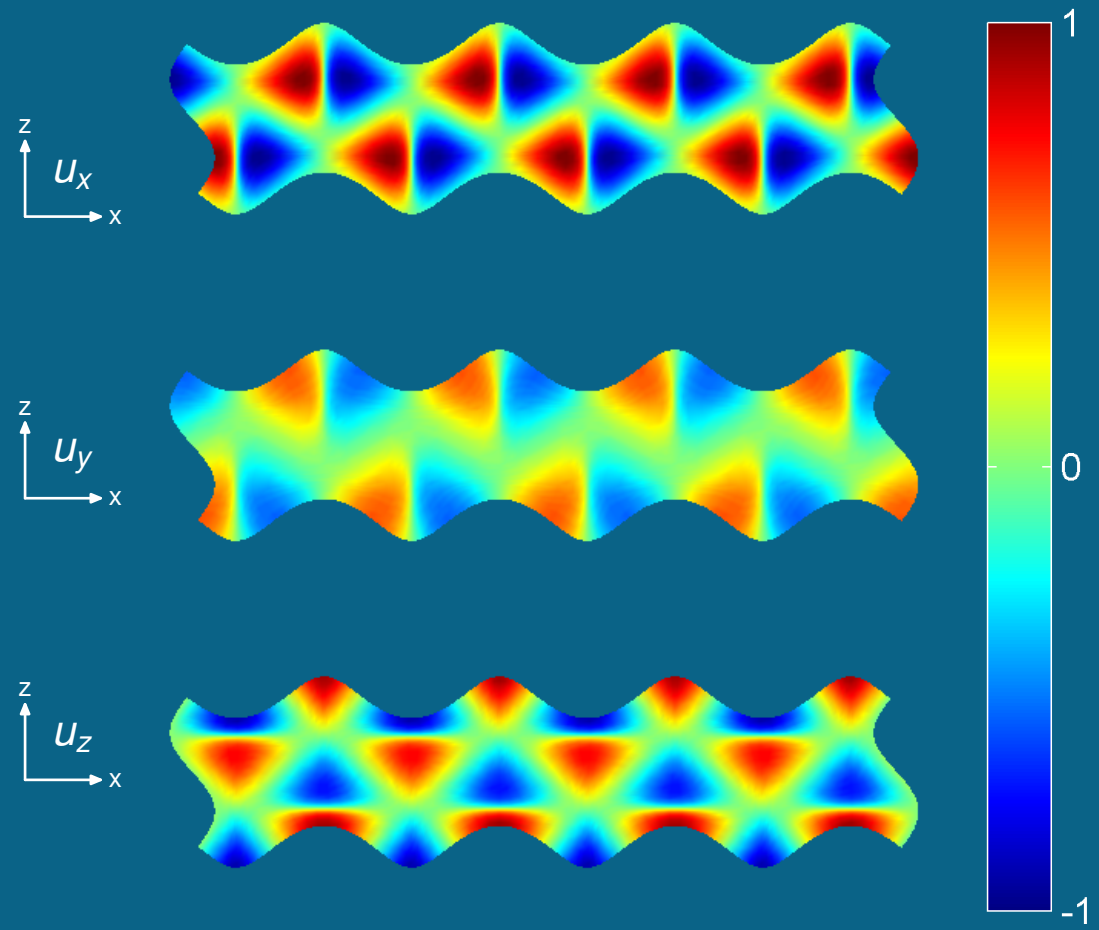
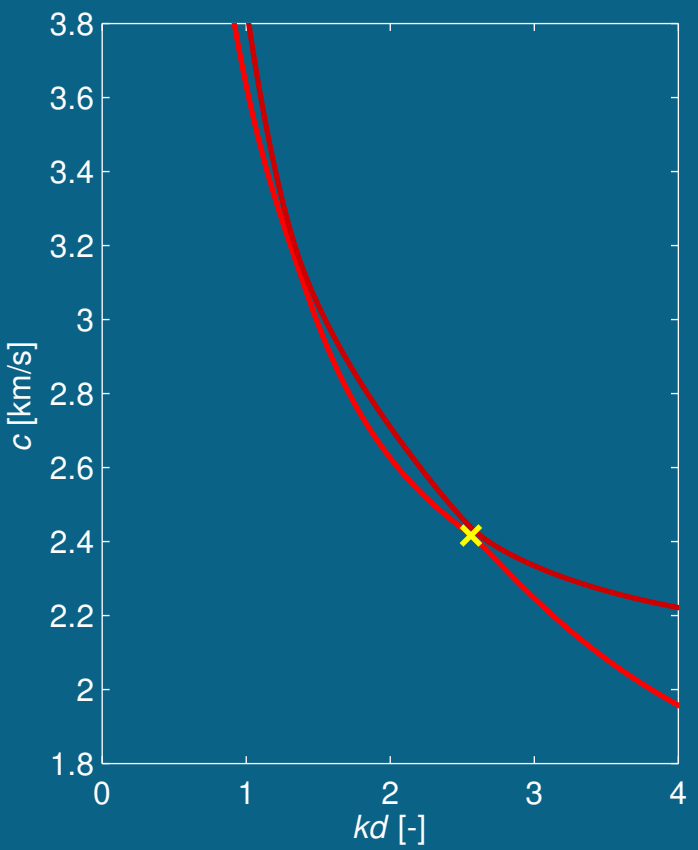
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.64$



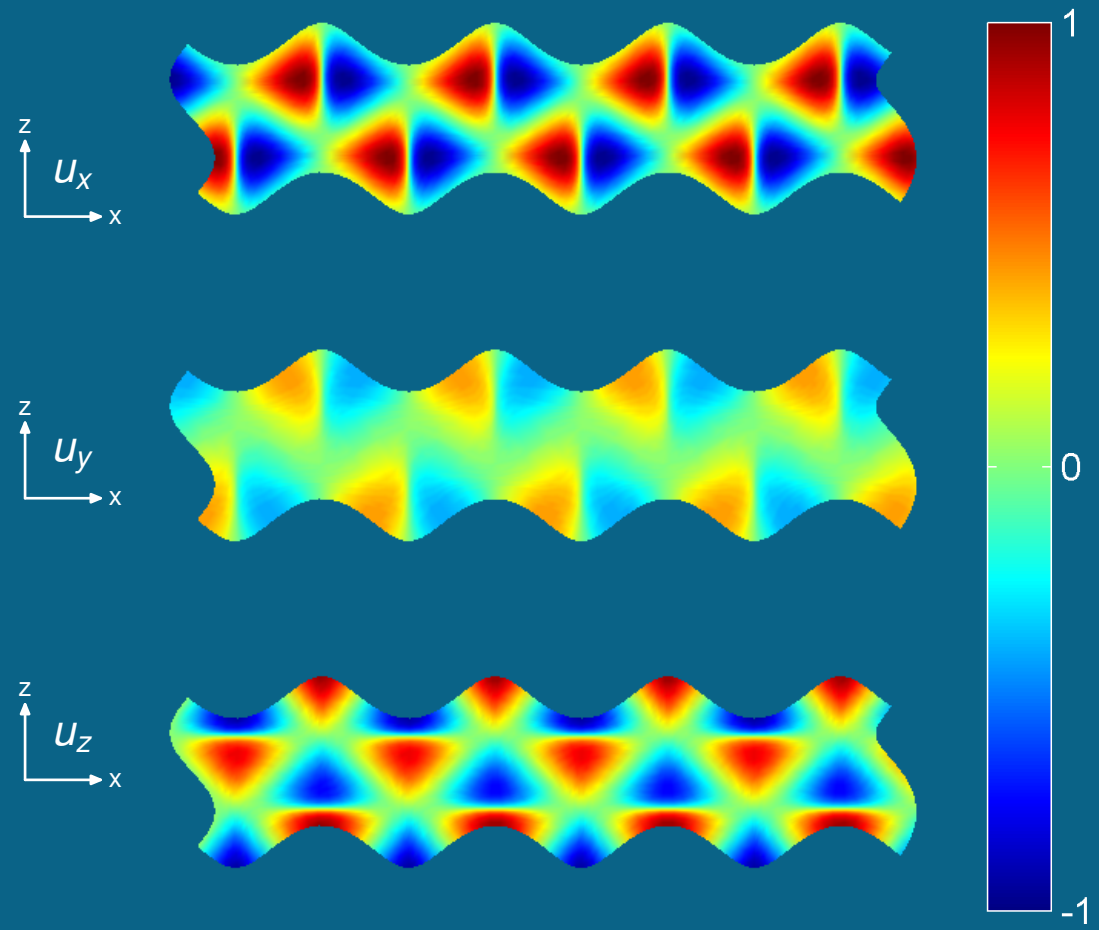
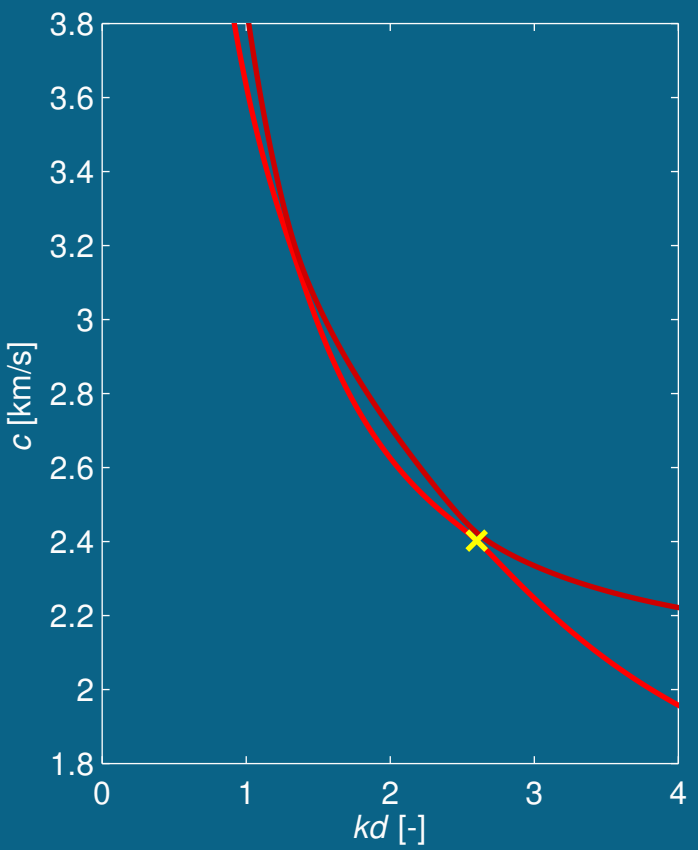
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.68$



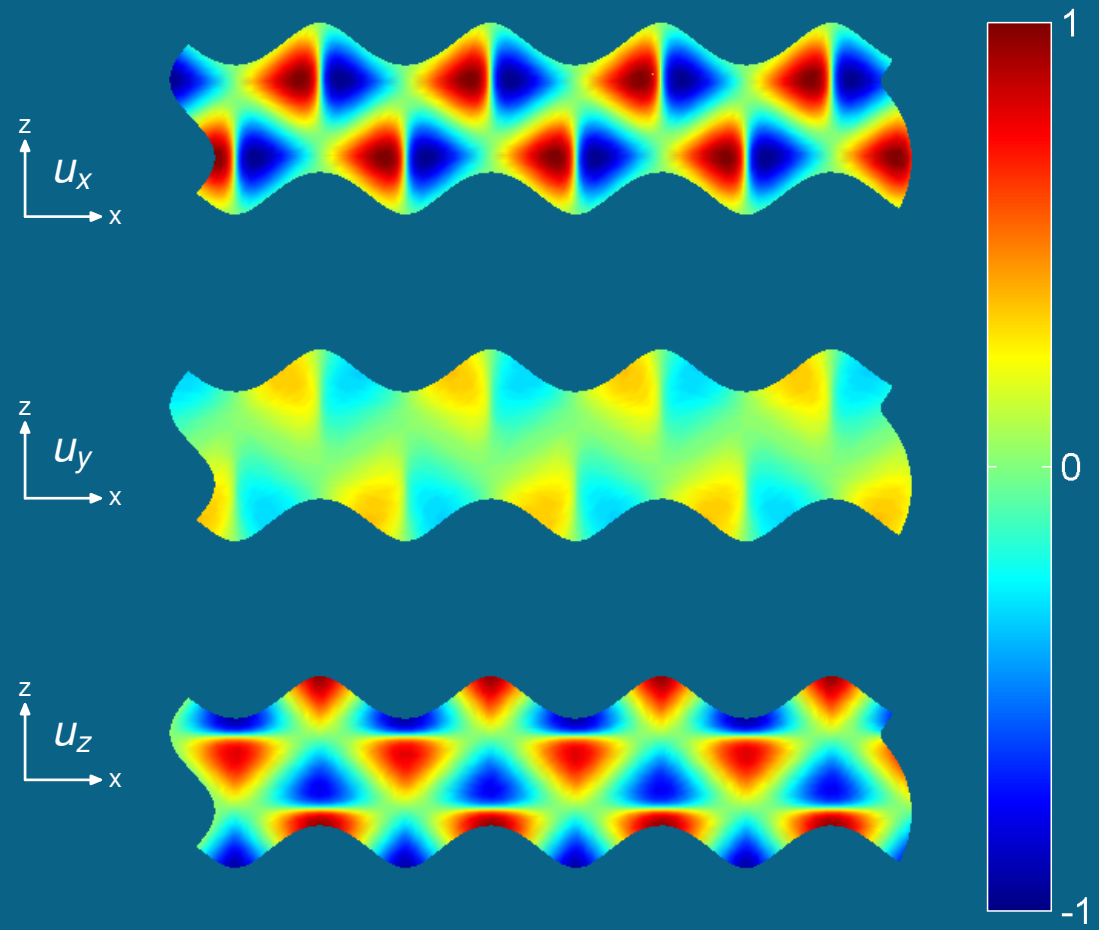
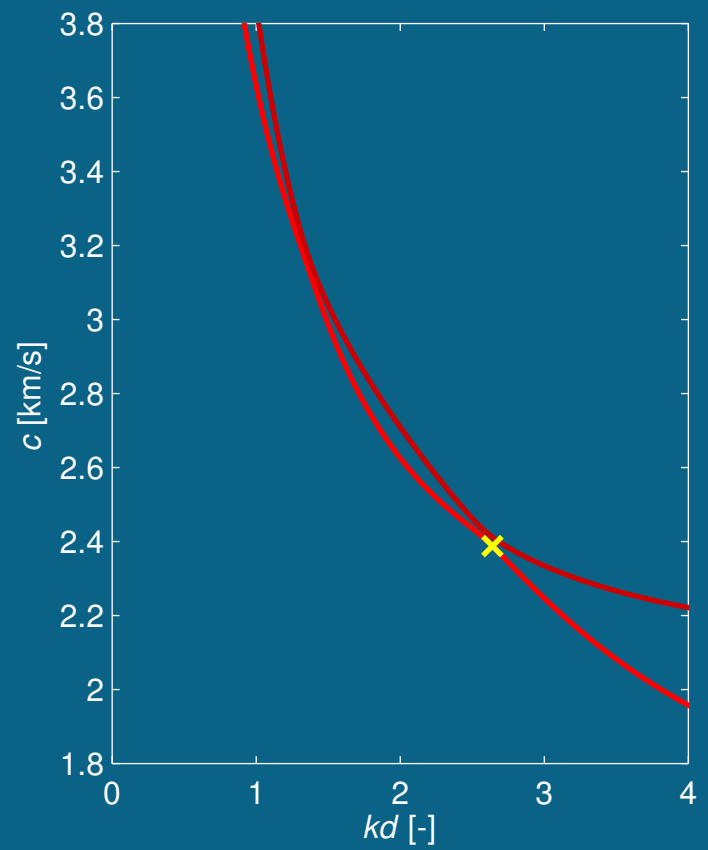
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.72$



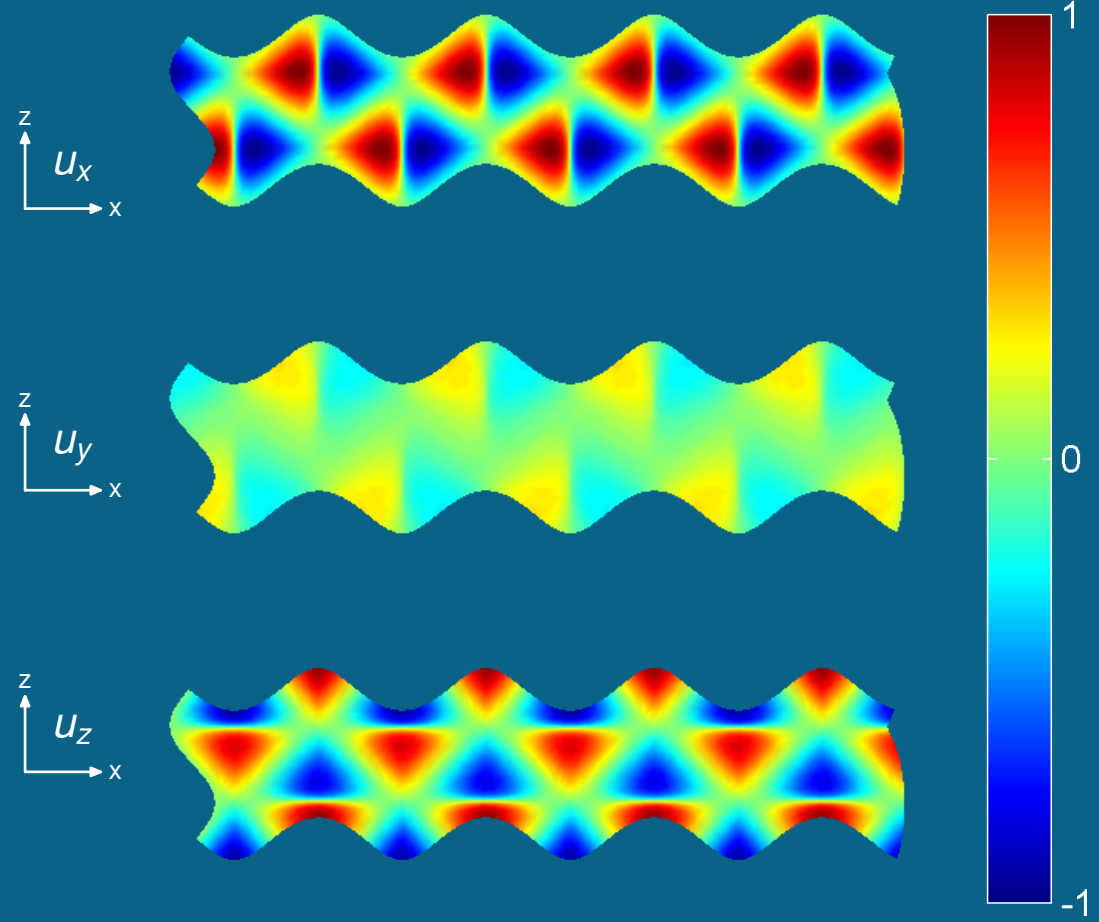
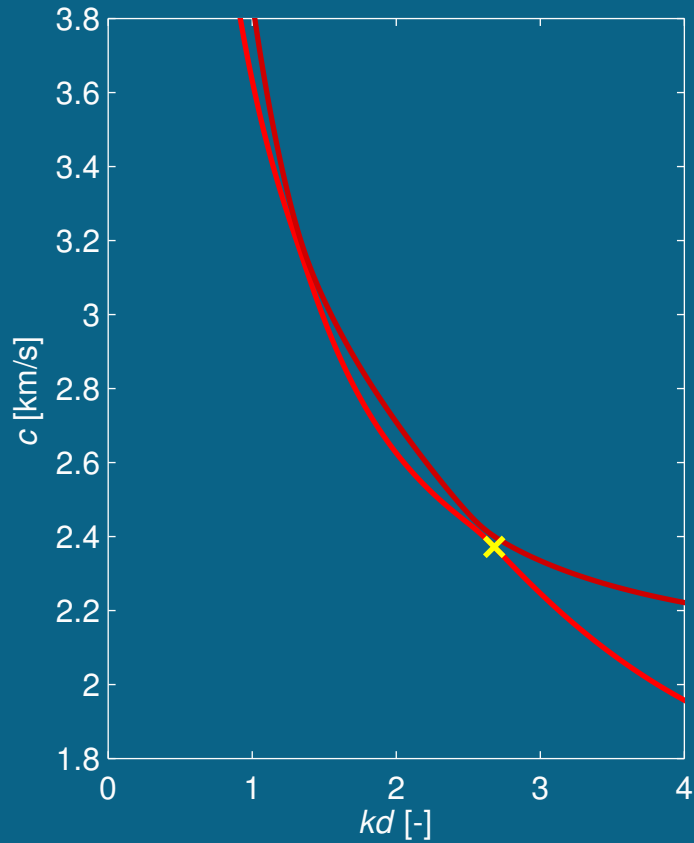
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.76$



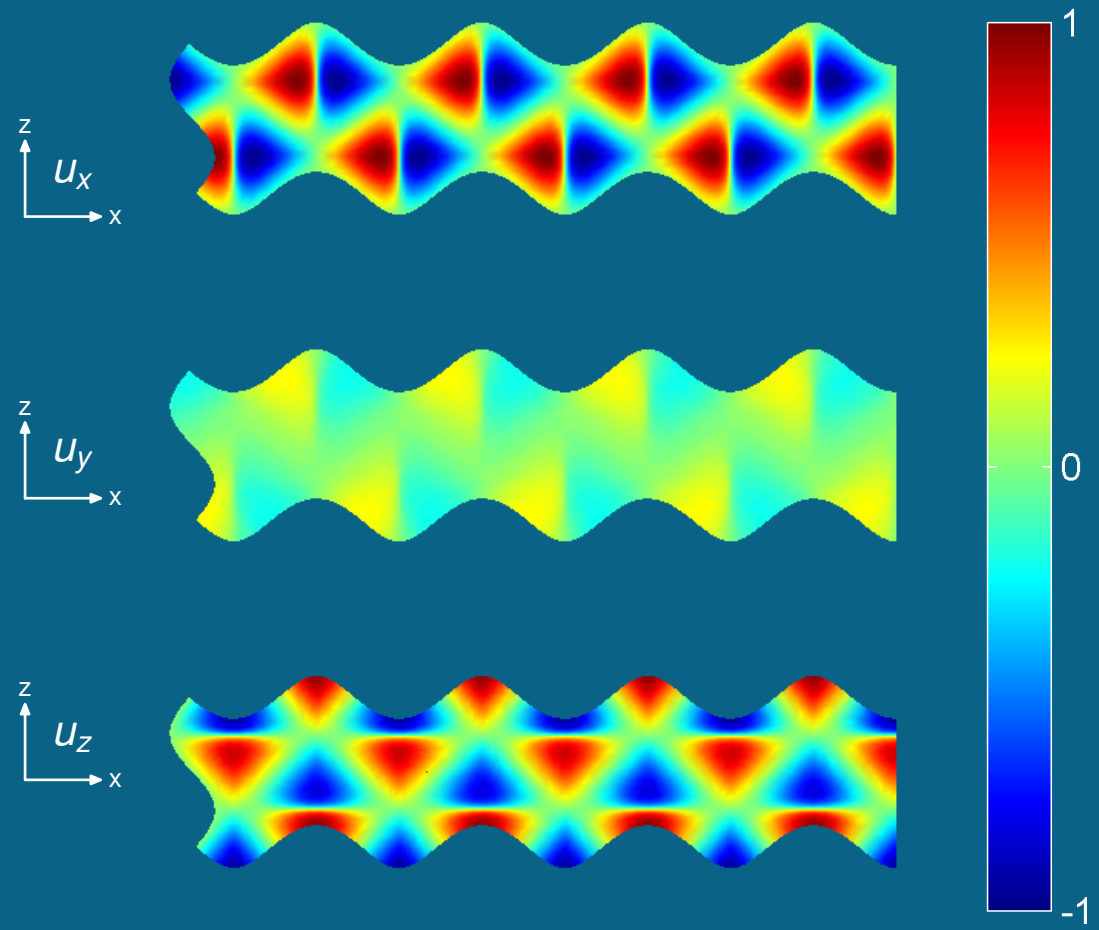
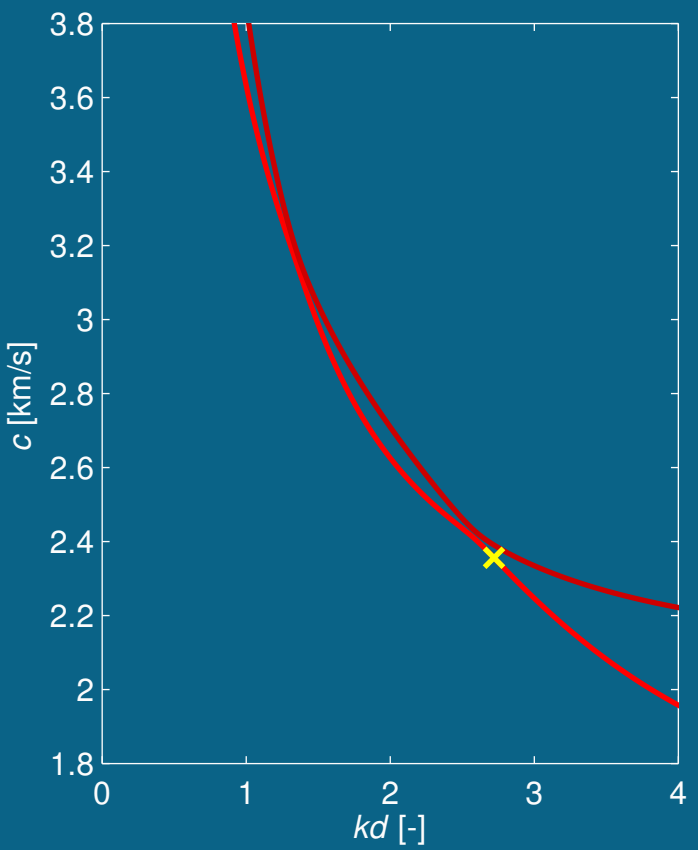
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.80$



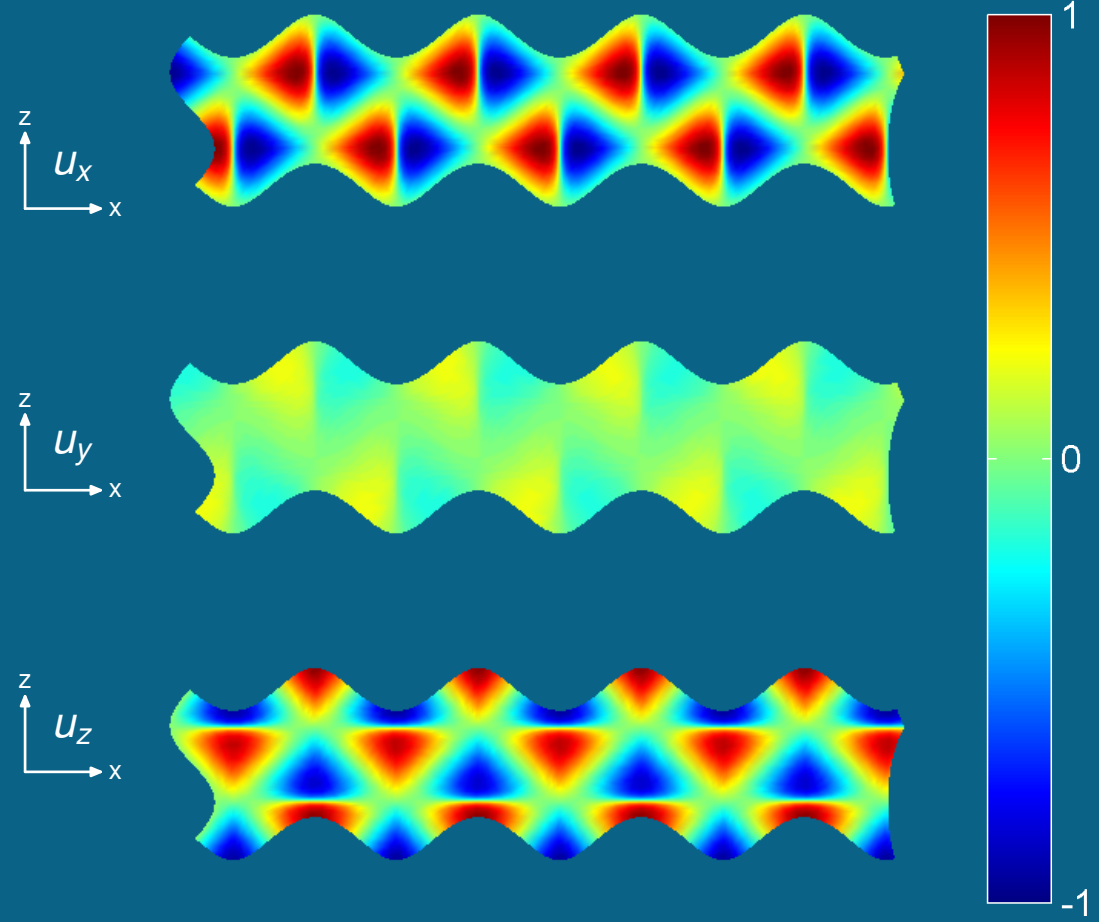
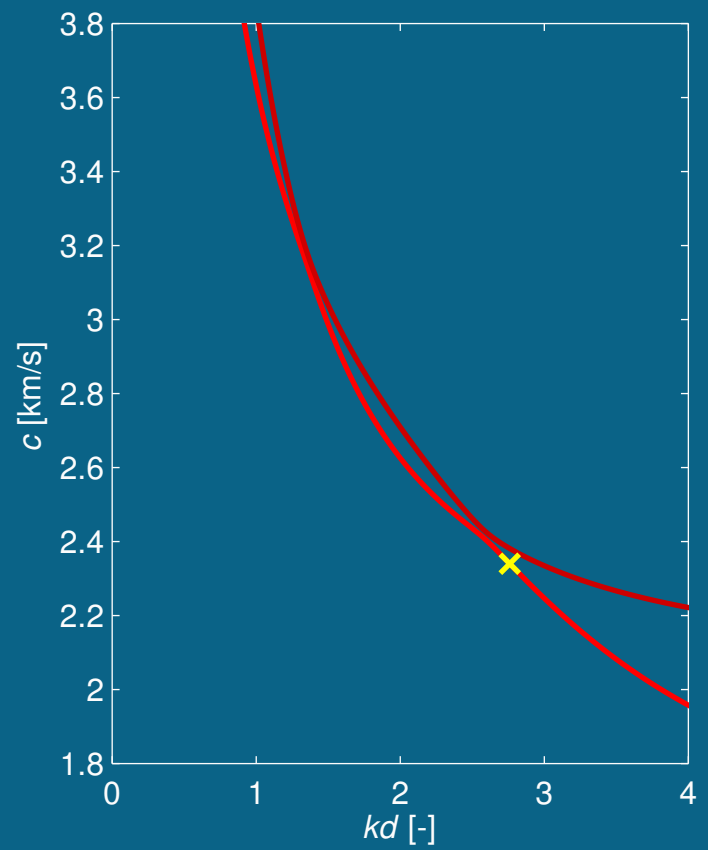
Výchyvky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.84$



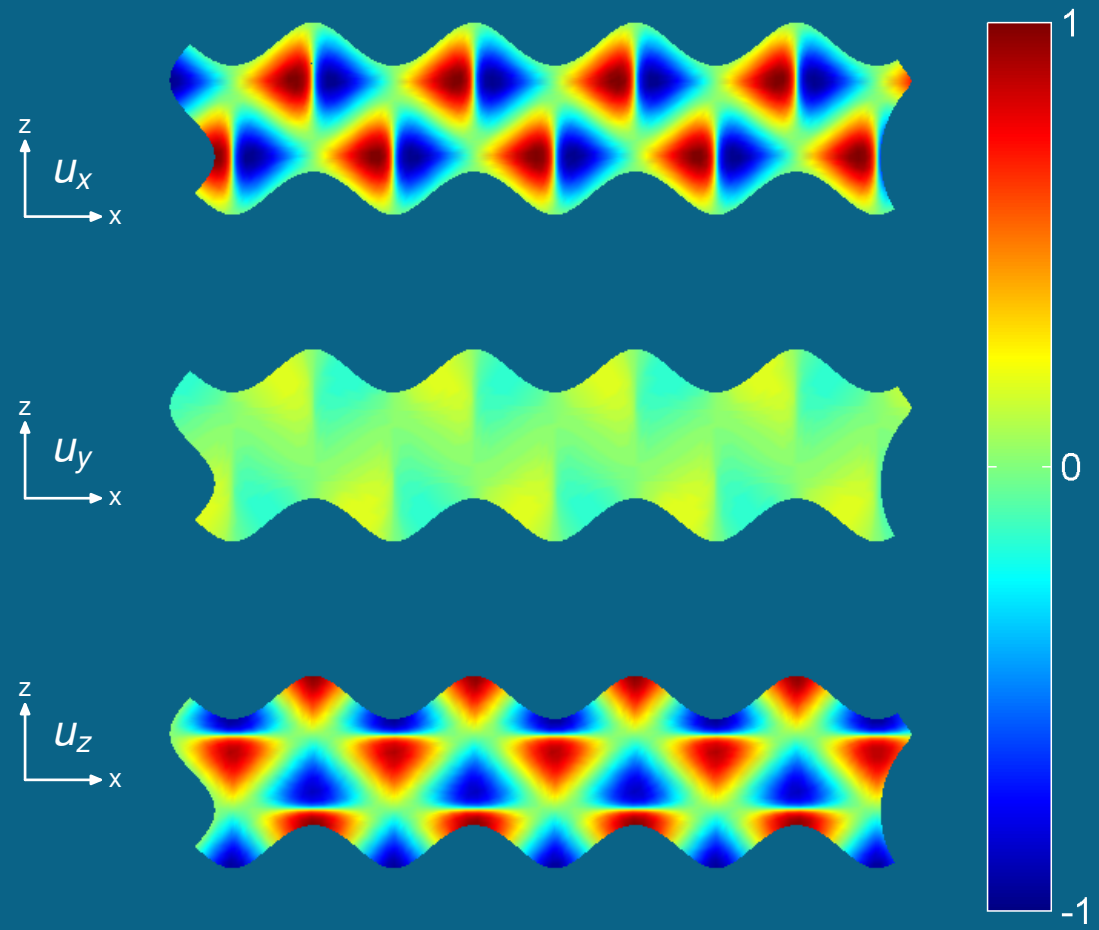
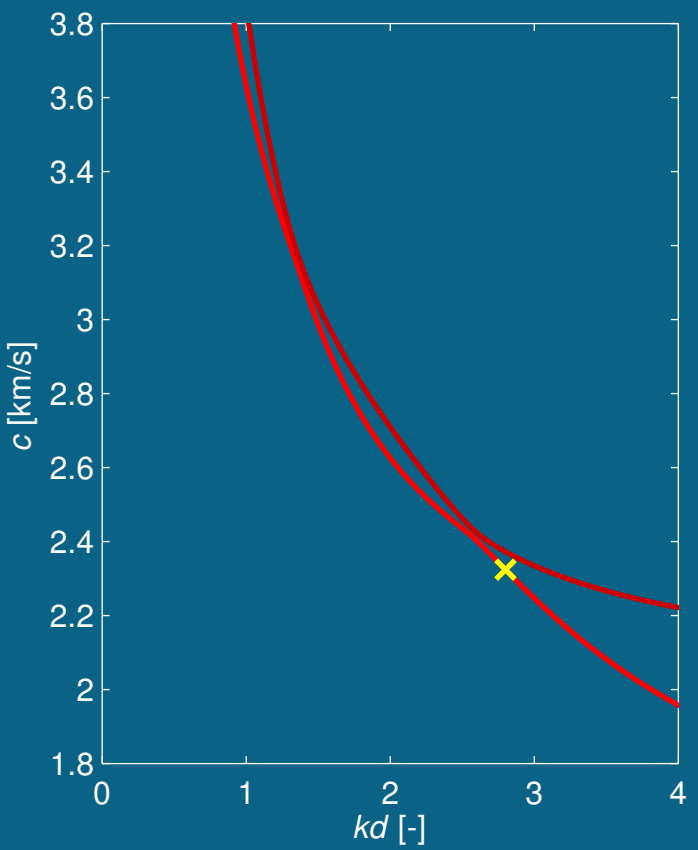
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.88$



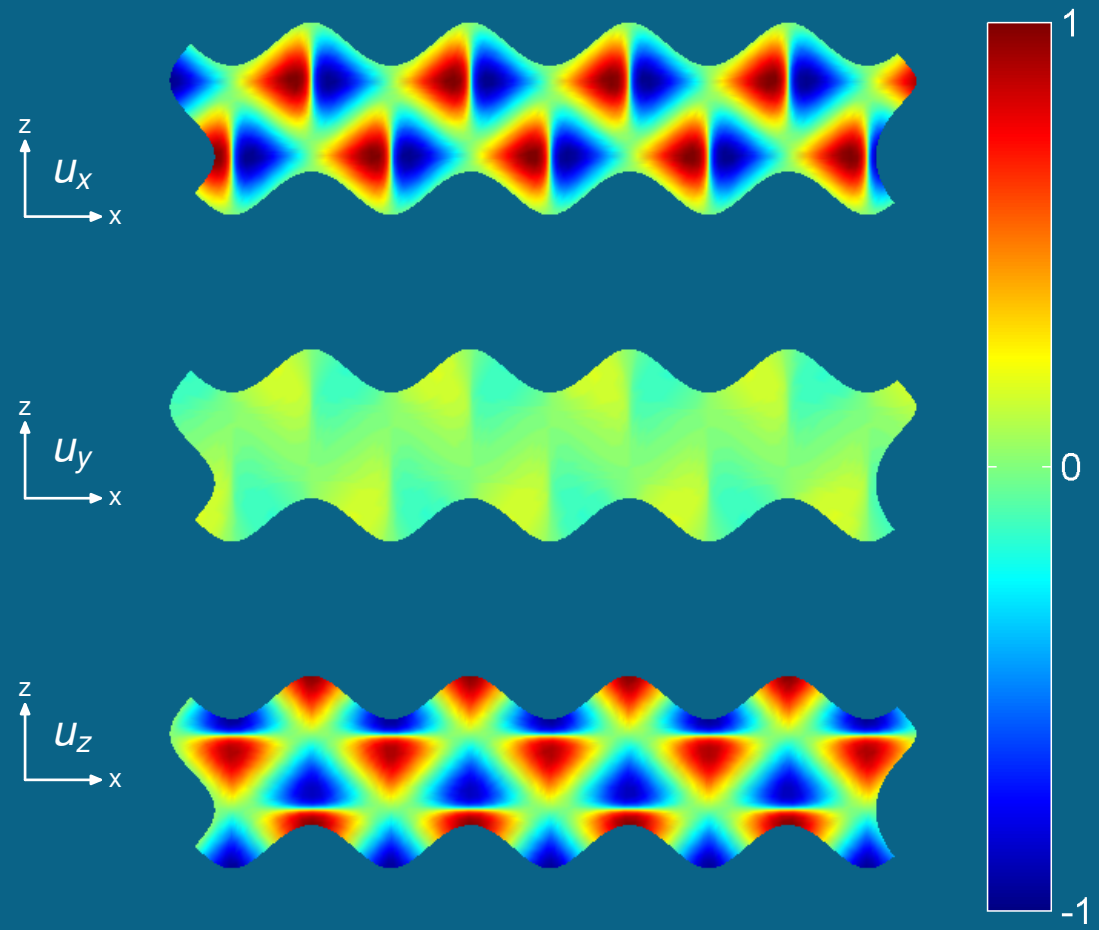
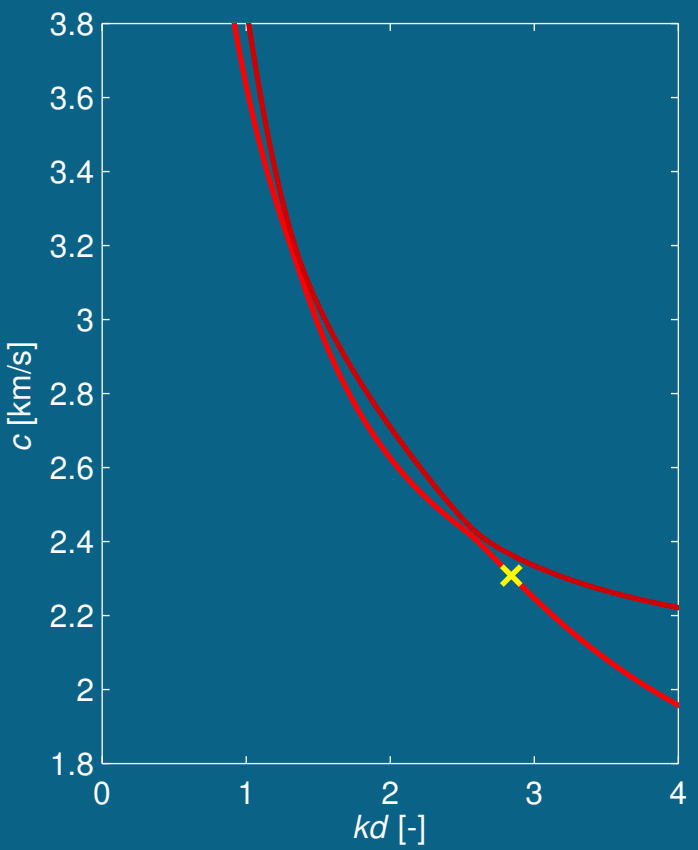
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.92$



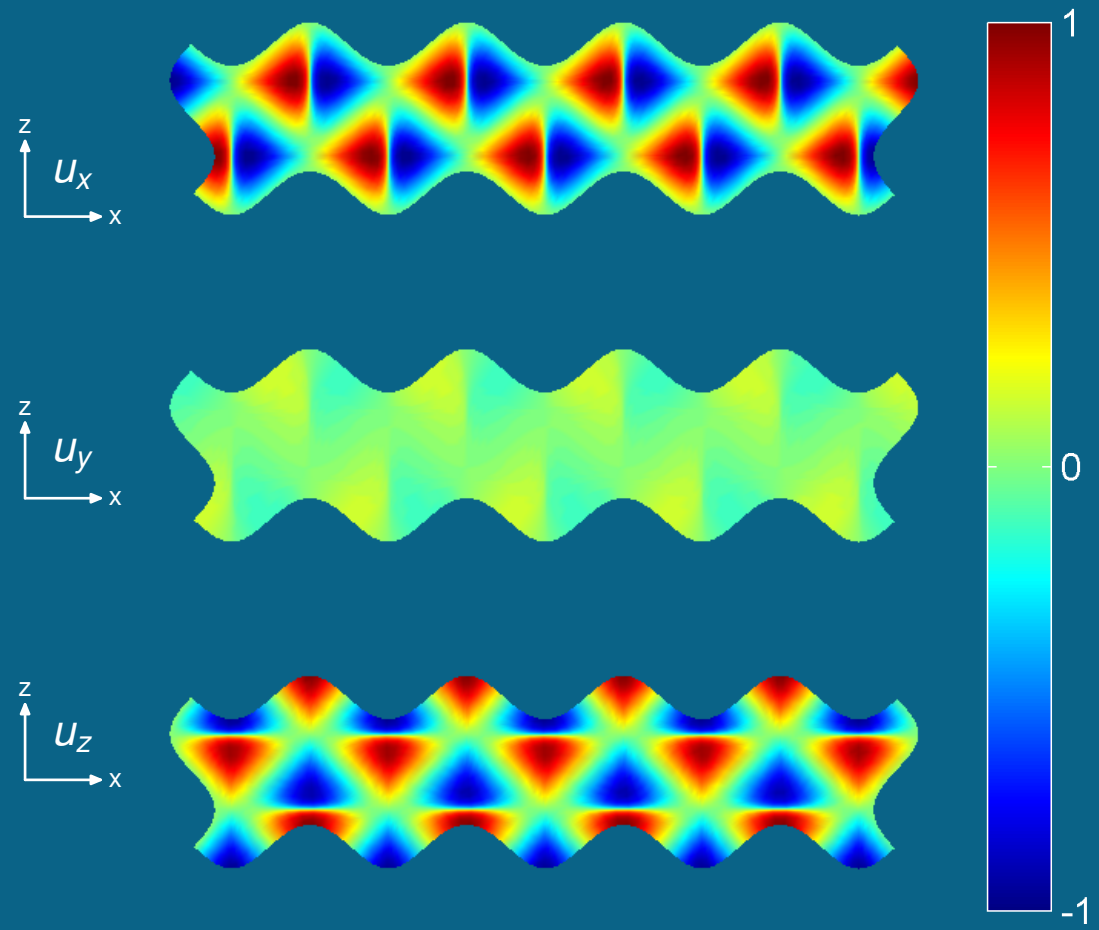
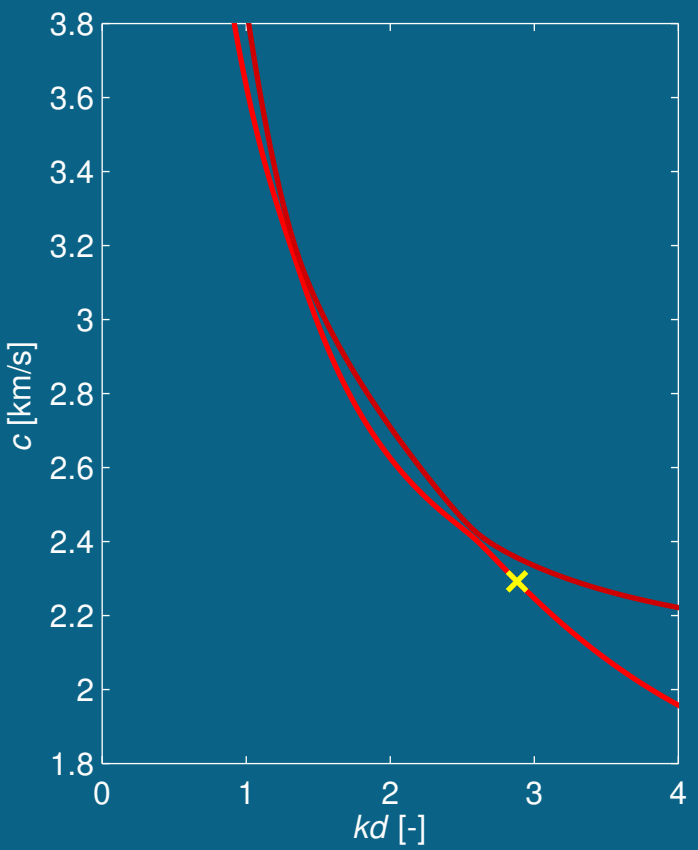
Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=2.96$



Výhylky pro 2. antisymetrický mód, směr šíření $\phi = 89^\circ$

$kd=3.00$



Závěr

- Disperzní vztahy pro obecný úhel šíření vln v ortotropní desce s orientací (001).
- Detekce a odstranění falešných disperzních křivek.
- Složky posuvů a napětí pro jednotlivé módy.

- Disperzní vztahy byly odvozeny pomocí metody parciálních vln.
- Při odvození disperzních závislostí byl použit systém pro symbolické výpočty Maple.
- K vyčíslení disperzních závislostí, složek posuvů a jich znázornění byl použit Matlab.
- Použité materiálové konstanty odpovídají uhlíkovému kompozitu.

OBSAH

Úvod

Disperzní vztahy pro obecný úhel šíření ϕ

Disperzní křivky pro symetrické módy
směr šíření $\phi = 45^\circ$

Disperzní křivky pro antisymetrické módy
směr šíření $\phi = 45^\circ$

Průběhy parametrů A,B,C pro $\phi = 45^\circ$

Závislost falešných kořenů (rychlostí) na směru šíření ϕ

Disperzní křivky

Výchyvky pro 1. symetrický mód

Výchyvky pro 2. antisymetrický mód

Závěr