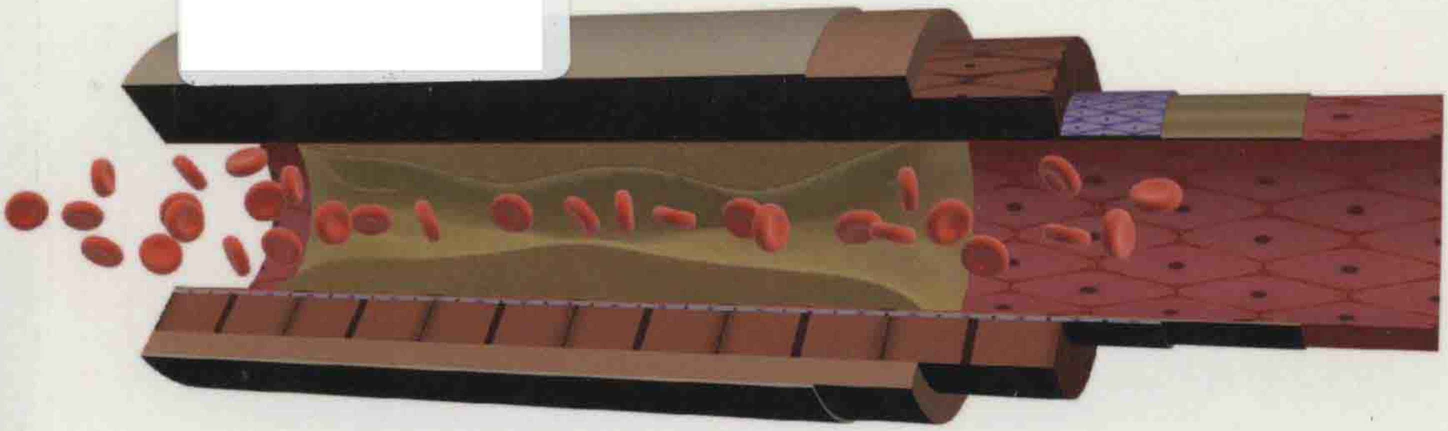

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Induced by Fluid-Structure Interaction

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I declare that I have set up this thesis by myself using the mentioned sources only.

Prague, 25th May 2010 Vítězslav Štembera

This book contains a slightly enlarged version of the original dissertation from 2010.

Prague, 21th January 2013 Vítězslav Štembera

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Notations

Latin symbols

$[\cdot]$		matrix form of the fourth order tensor
A	$[\mathrm{m}^2]$	cross-sectional area of the tube
A_0	$[\mathrm{m}^2]$	cross-sectional area of the rigid tube
$a_k,\ b_k$		element shape functions
$\mathbf{a}_0,\ \mathbf{g}_0$		unit vectors describing fiber directions
$\mathbf{b} = \mathbf{F}\mathbf{F}^{\mathrm{T}}$		left Cauchy-Green deformation tensor
c	$[\mathrm{m\,s^{-1}}]$	sound speed in fluid
$\mathbf{c}$		right Cauchy-Green deformation tensor (matrix form)
$\mathbf{C} = \mathbf{F}^{\mathrm{T}}\mathbf{F}$		right Cauchy-Green deformation tensor
$\mathbb{C}$	[Pa]	elasticity tensor
D	[m]	diameter of the tube
D_0	[m]	diameter of the rigid tube; tube diameter in undeformed state
$\mathbf{e}$		small deformation tensor
E	$[\mathrm{N\,m^{-2}}]$	Young's modulus
$\mathcal{E}$		element index set
f	[Hz]	frequency
f	$[\mathrm{N\,kg^{-1}}]$	frictional force exerted on one kilogram of mass
$\mathbf{F} = \frac{\partial \mathbf{x}}{\partial \mathbf{X}}$		the deformation tensor
g	$[\mathrm{m\,s^{-2}}]$	Earth's gravitational acceleration
$\mathbf{g}$		Green-Langrange deformation tensor (vector form)
$\mathbf{G}$		Green-Langrange deformation tensor
h	[m]	distance between two neighboring nodes
h_0	[m]	tube thickness
$I_1,\ I_2,\ I_3$		invariants of tensor $\mathbf{C}$
$\mathbf{I}$		(second-order) identity tensor

$J = \det\mathbf{F}$		determinant of the deformation tensor
J_0	$[\mathrm{m}^4]$	second moment of area
J_4		anisotropy pseudo-invariant
J_m		fiber extensibility parameter
$J_\mathrm{m}^\mathrm{aniso}$		anisotropic fiber extensibility parameter
$\mathcal{J}$		Jacobi matrix of mapping Ψ
k	[m]	roughness of the tube's inner surface
$\mathbf{K}$	$[\mathrm{N\,m^{-1}}]$	stiffness matrix
l	[m]	length of the flexible tube
l_0	[m]	length of the rigid tube
m	[kg]	mass
M	[N m]	moment of a force
n_LS		number of load steps
N		number of element nodes; number of fluid grid points
N_p		number of element pressure unknowns
$\mathcal{N}$		node index set
p	[Pa]	separately interpolated pressure; fluid pressure
$\bar{p}$	[Pa]	pressure computed from displacement
p_e	[Pa]	pressure outside of the tube/channel
p_u	[Pa]	upstream fluid pressure
p_d	[Pa]	downstream fluid pressure
p_S	[Pa]	fluid pressure in reservoir
p_in	[Pa]	fluid pressure before the upstream restrictor
p_I	[Pa]	fluid pressure behind the upstream restrictor
p_E	[Pa]	fluid pressure before the downstream restrictor
p_out	[Pa]	fluid pressure behind the downstream restrictor
P_i		i-th element node
$\mathbf{q}$	[m]	discretized displacement vector
Q	$[\mathrm{m^3\,s^{-1}}]$	flow rate