

# Představení software COMSOL Multiphysics a COMSOL Server

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Fyzikální jev



Počítačová simulace



Sdílení aplikace

Equation

Show equation assuming:

Study 1, Time Dependent

$$e_a \frac{\partial^2 \mathbf{u}}{\partial t^2} + d_a \frac{\partial \mathbf{u}}{\partial t} + \nabla \cdot \Gamma = f$$

$$\mathbf{u} = [u_1, u_2]^T$$

$$\nabla = \left[ \frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z} \right]$$

Conservative Flux

-u1x	x
-u1y	y
-u1z	z
$\Gamma$	
0	x
0	y
0	z

Source Term

$$f = (\alpha - u_1) * (u_1 - 1) * u_1 - u_2$$
$$\epsilon * (\beta * u_1 - \gamma * u_2 - \delta)$$

Damping or Mass Coefficient

$d_a$	1	0
	0	1

Mass Coefficient

$e_a$	0	0
	0	0

Mathematics

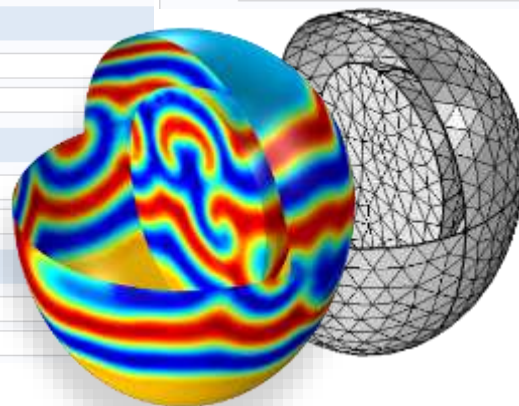
- ▷  $\Delta u$  PDE Interfaces
- ▷  $\frac{d}{dt}$  ODE and DAE Interfaces
- ▷ Optimization and Sensitivity
- ▷  $\nabla^2$  Classical PDEs
- ▷ Moving Interface
- ▷ Deformed Mesh
- Wall Distance (wd)
- Mathematical Particle Tracing (pt)
- Curvilinear Coordinates (cc)

Show equation assuming:

$$0 = \int_{\Omega} \text{weak} \partial V$$

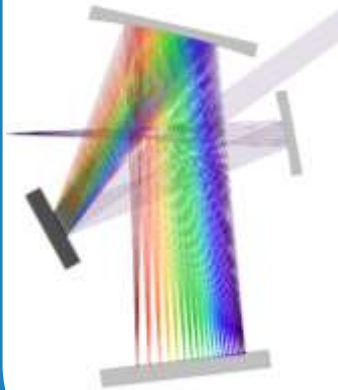
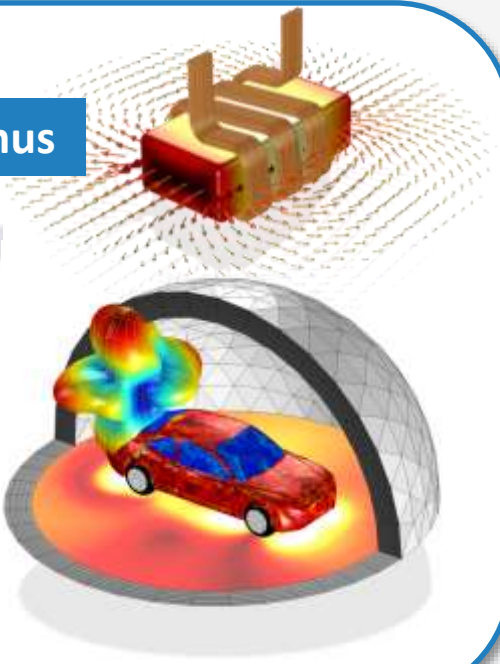
Weak Expressions

weak  $-\text{test}(u_x) * u_x - \text{test}(u_y) * u_y - \text{test}(u_z) * u_z + 1[m^{-2}] * \text{test}(u)$



# Vlastní PDR / ODR

# Elektromagnetismus



- Mathematics
- Δu PDE Interfaces
- $\frac{d}{dt}$  ODE and DAE Interfaces
- Optimization and Sensitivity
- ∇<sup>2</sup> Classical PDEs
- Moving Interface
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Show equation assuming:

$$0 = \int_{\Omega} \text{weak } \partial V$$

Weak Expressions

weak `-test(ux)*ux-test(uy)*uy-test(uz)*uz+1[m^-2]*test(u)`

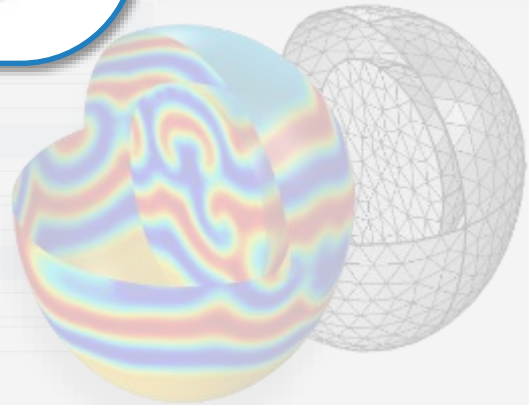
$\epsilon \cdot (\beta \cdot u_1 - \gamma \cdot u_2 - \delta)$

▼ Damping or Mass Coefficient

$d_a$	1	0
	0	1

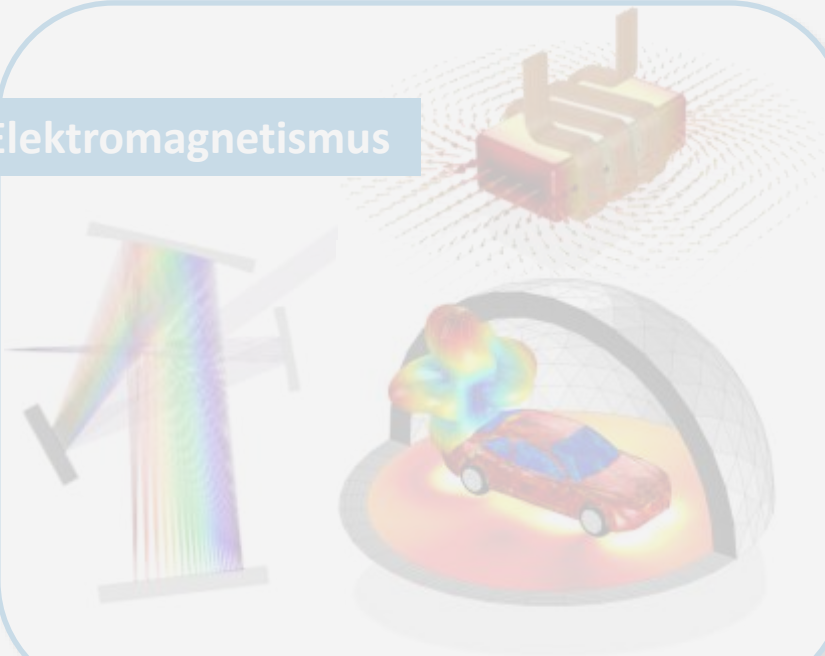
▼ Mass Coefficient

$e_a$	0	0
	0	0



# Vlastní PDR / ODR

## Elektromagnetismus



- Mathematics
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Show equation assuming:

$$0 = \int$$

weak

$f$   
epsilon\*(beta\*u1-gamma\*u2-delta)

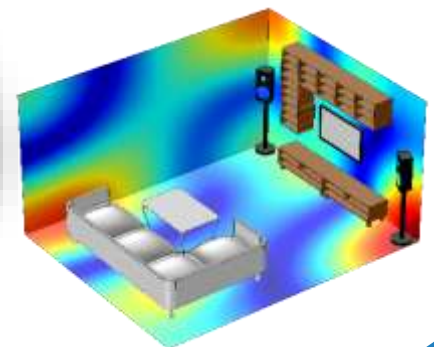
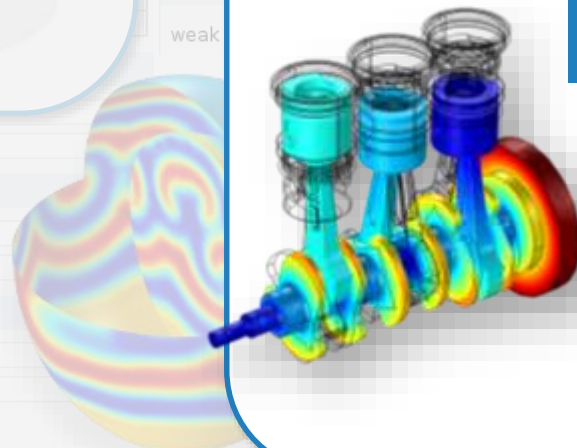
Damping or Mass Coefficient

$d_a$	1	0
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Mass Coefficient

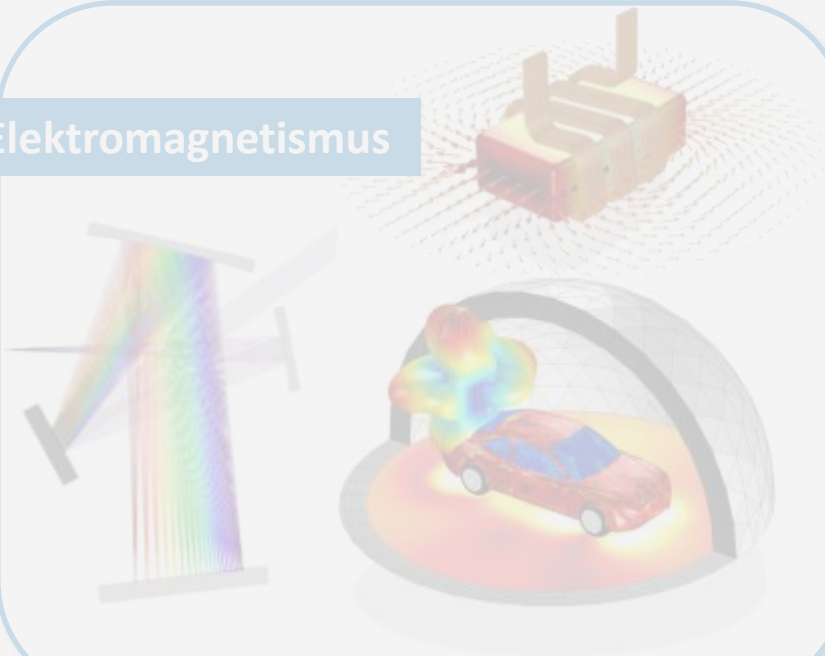
$e_a$	0	0
	0	0

## Strukturální Mechanika a Akustika

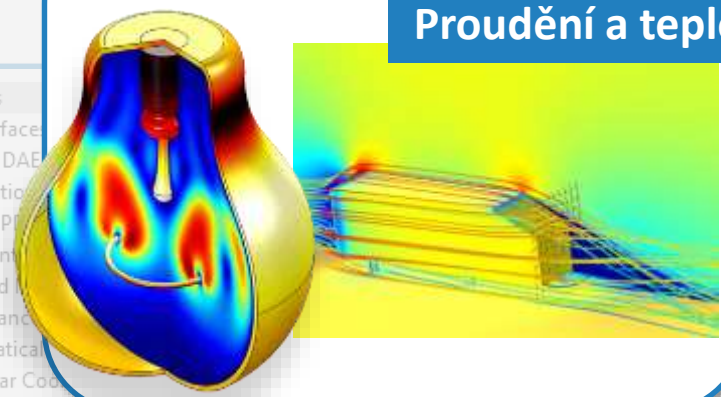


## Vlastní PDR / ODR

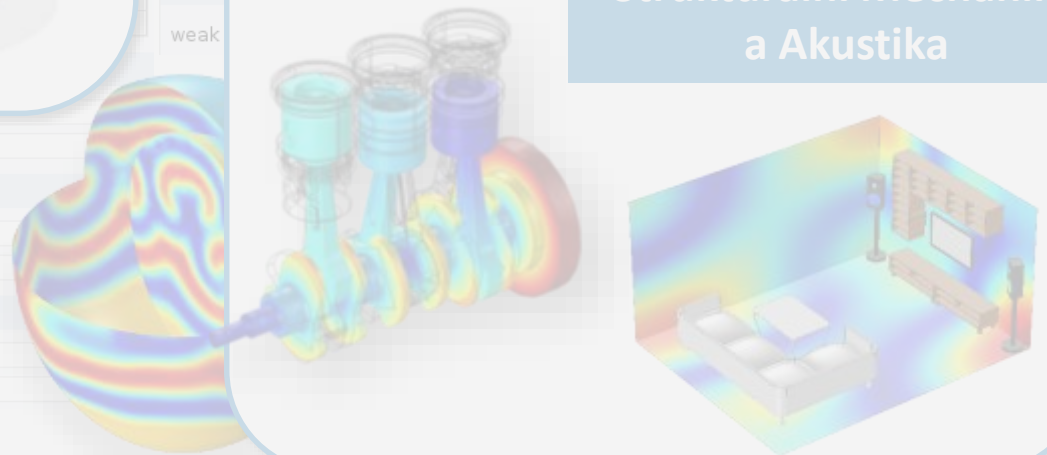
## Elektromagnetismus



## Proudění a teplo



## Strukturální Mechanika a Akustika



## Vlastní PDR / ODR

$f$   $\epsilon \cdot (\beta \cdot u_1 - \gamma \cdot u_2 - \delta)$

Damping or Mass Coefficient		
$d_a$	1	0
	0	1

Mass Coefficient		
$e_a$	0	0
	0	0

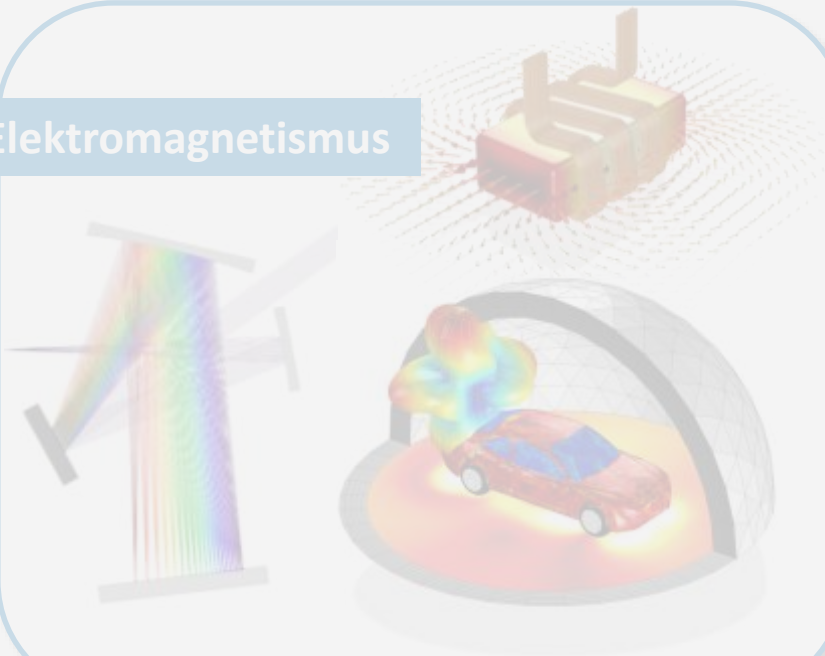
- Mathematics
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- $\nabla^2$  Classical PDE
- Moving Interface
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- Wall Distance
- Mathematical Function
- Curvilinear Coordinate

Show equation assuming:

$$0 = \int_{\Omega} \dots$$

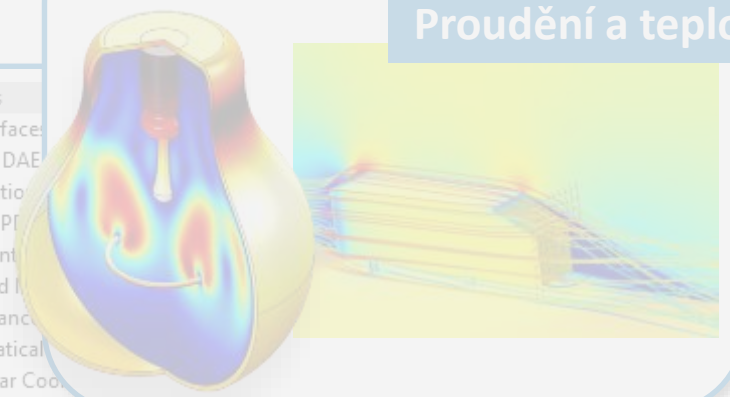
weak

## Elektromagnetismus

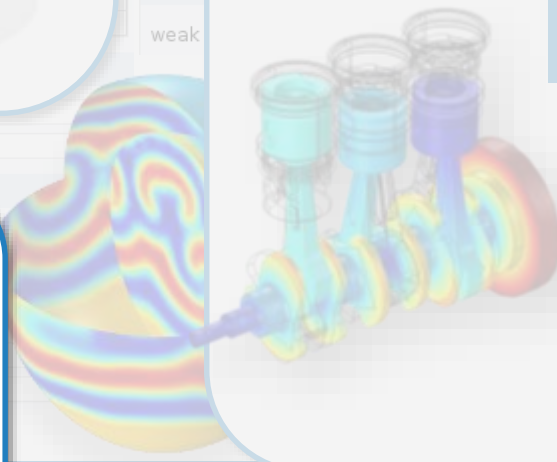


## Proudění a teplo

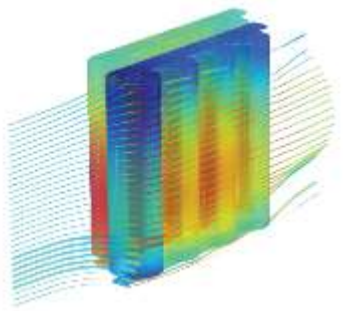
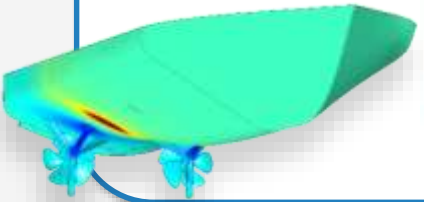
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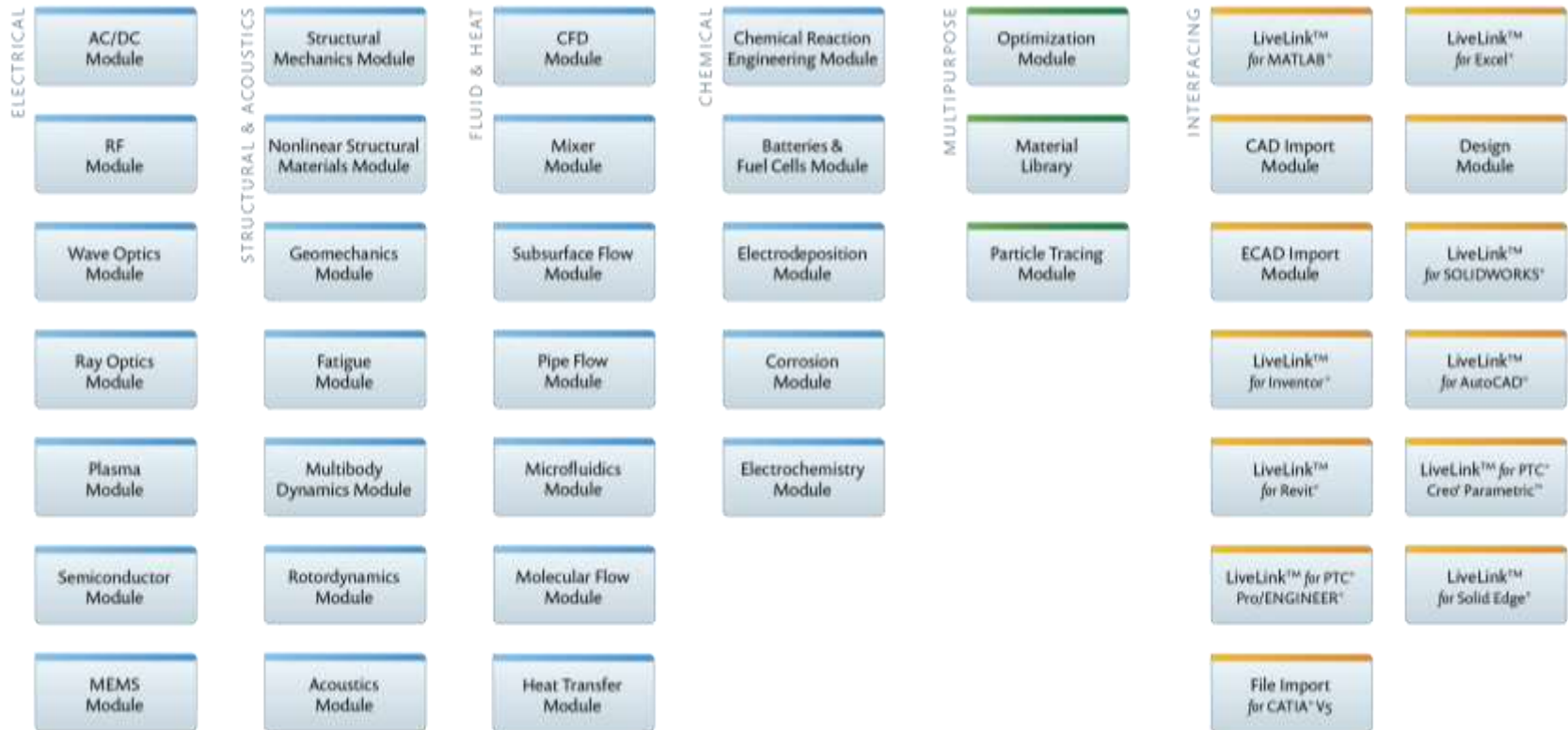


## Chemie a elektrochemie



## Vlastní PDR / ODR

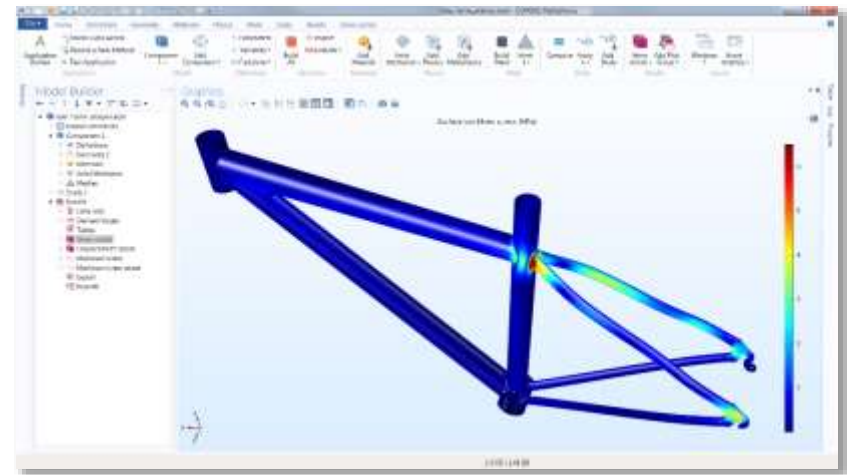
# Tisíce fyzikálních jevů – jedno ovládání



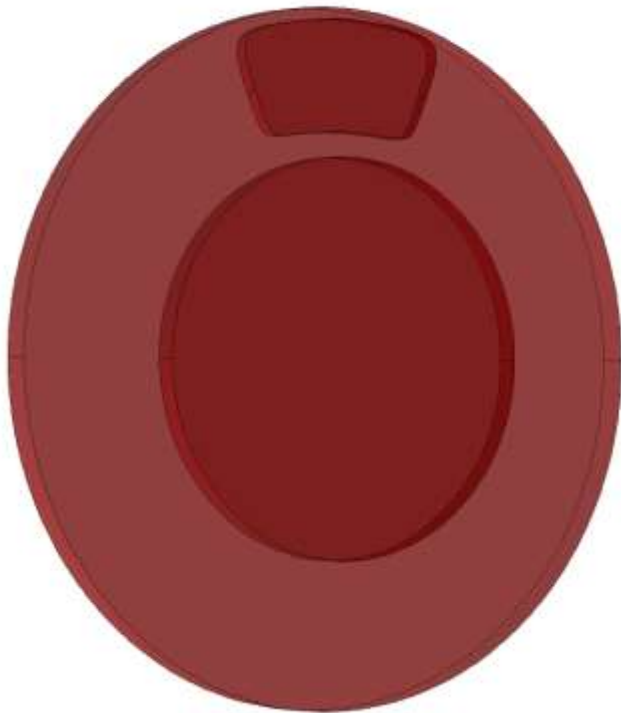


# Komplexní nástroj

- Tvorba nebo import CAD geometrie modelu
- Výpočet
- Zpracování a vizualizace výsledků

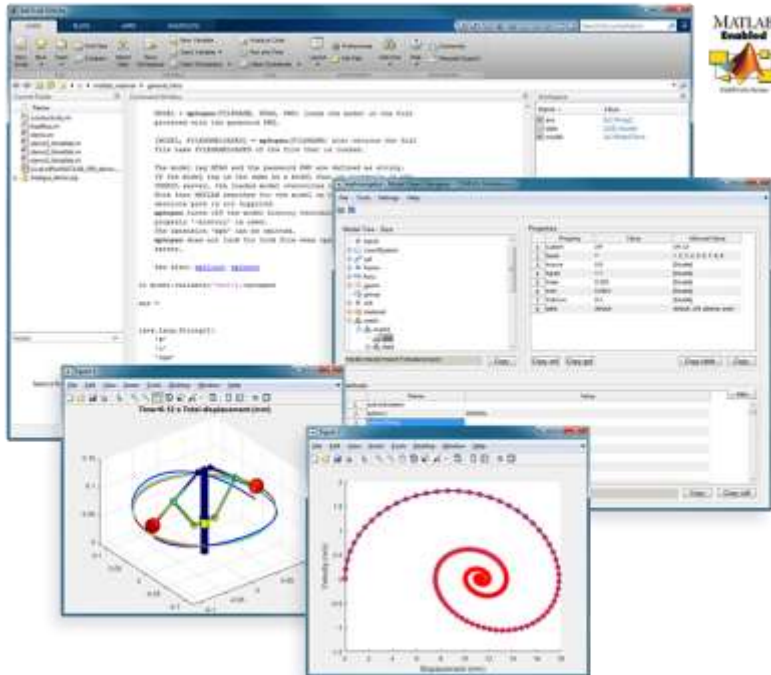


# Schopnost řešit multifyzikální úlohy



- Vzájemně se ovlivňující fyzikální jevy
- Jeden není možné řešit bez druhého
- Řešení různých fyzik na jednom modelu díky snadnému předávání dat

# Propojení s MATLABem



- Historická spojitost
- Uložte a upravujte model jako \*.m file
- Použití MATLAB funkcí
- Export/Import



Chytte nás