PRASS III

GŁÓWNY INSTYTUT GÓRNICTWA

PRASS III PROJECT

PRODUCTIVITY AND SAFETY OF SHIELD SUPPORT

RFCS PROJECT # 752504

COMPUTER AIDED SHIELD SUPPORT DESIGN BASED MODELLING OF HYDRAULIC SUPPLY SYSTEM, STRENGTH ANALYSIS AND LOCAL GEOLOGICAL CONDITIONS

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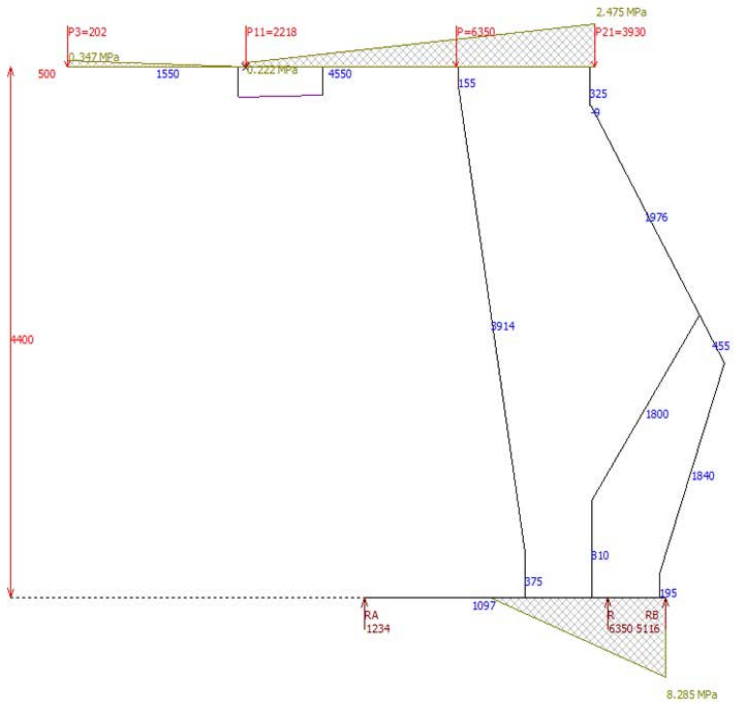
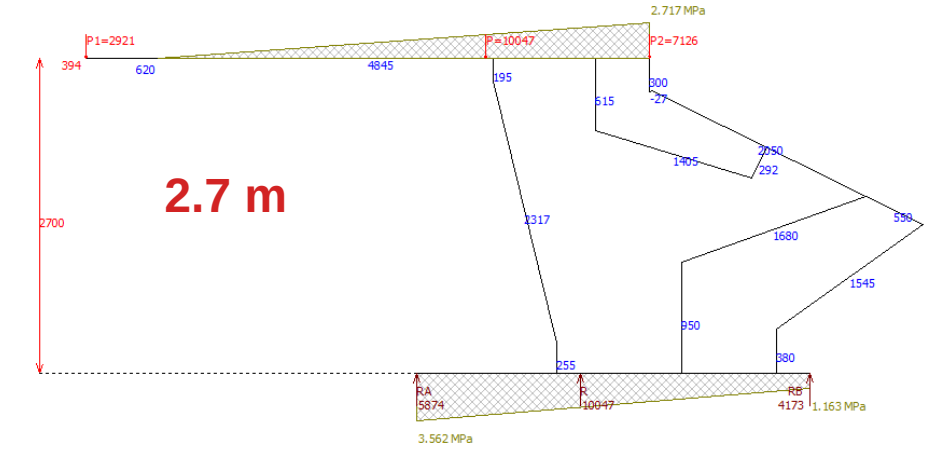
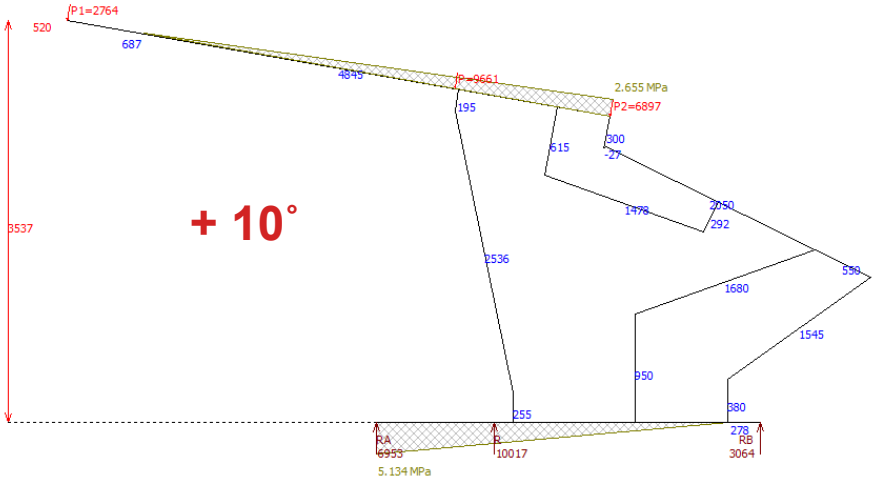
Powered roof support model

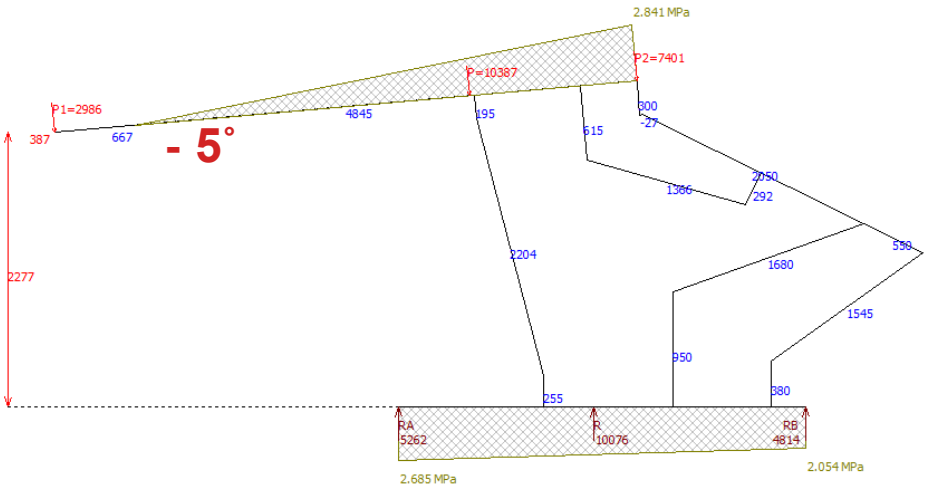
Exemplary geometric data	
- support height	1.9-4.5 m
- shield width	1.5 m
- support advance	0.85 m
- canopy length	4550 mm
- number of legs	2
- leg diameter	Ø 320 mm
- setting load	4.021–4.826 MN
- yield load	6.112 MN
- yield load density	0.75-0.80MN/m^2
- setting pressure	25-30 Mpa
- yield pressure	38 MPa



Powered roof support model







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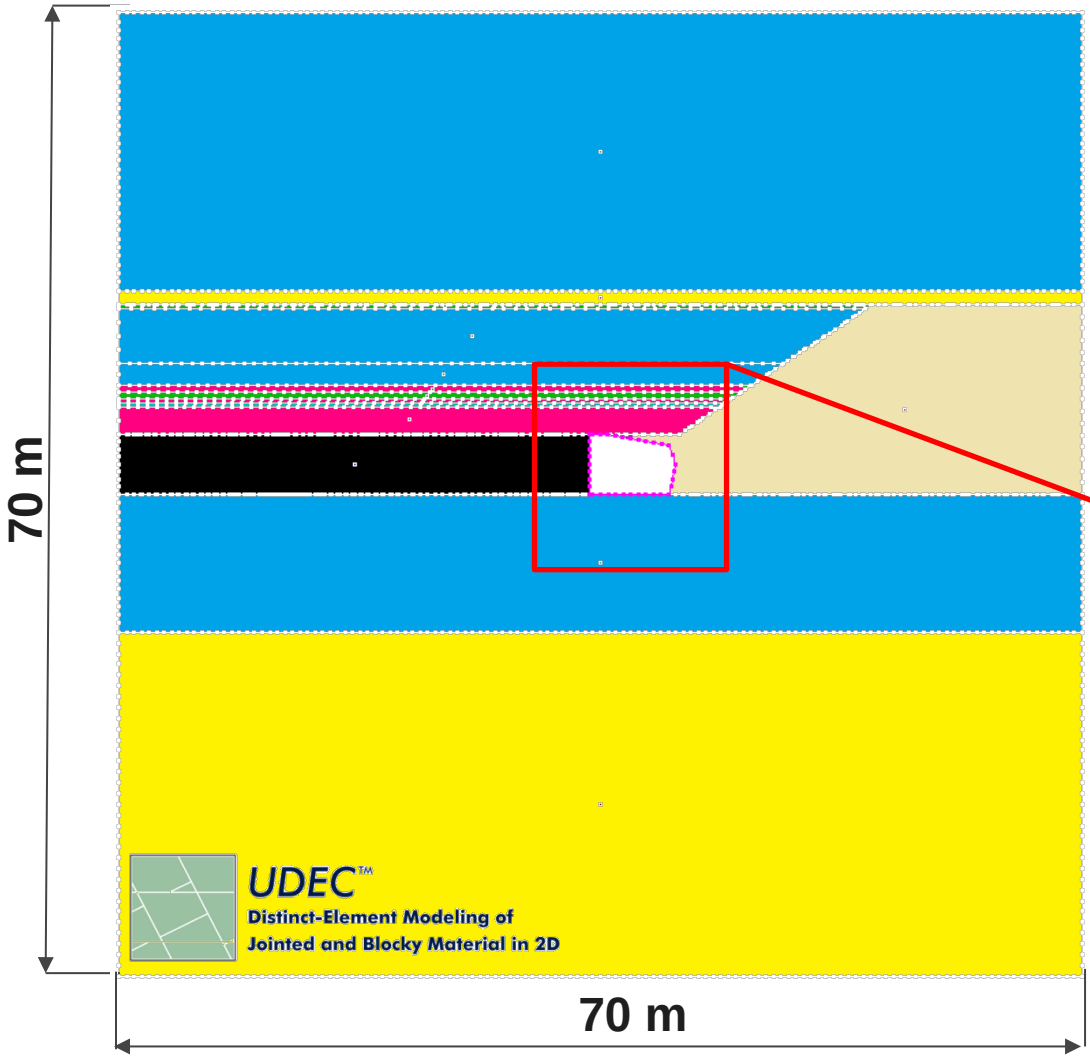
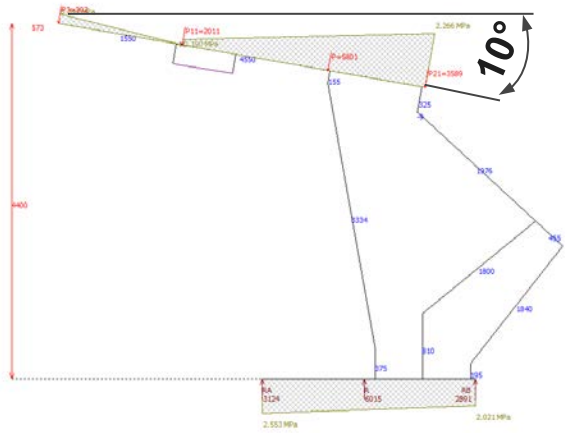
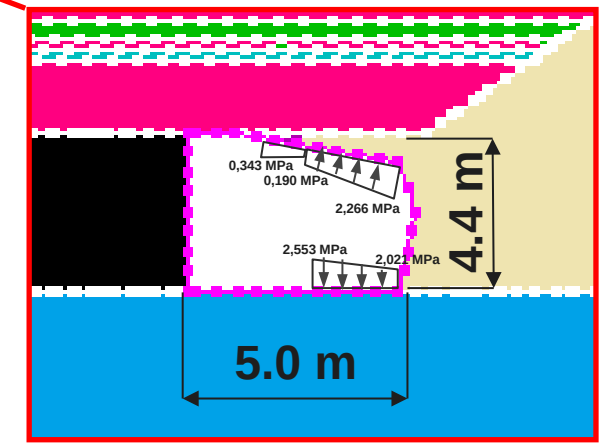
Powered roof support model







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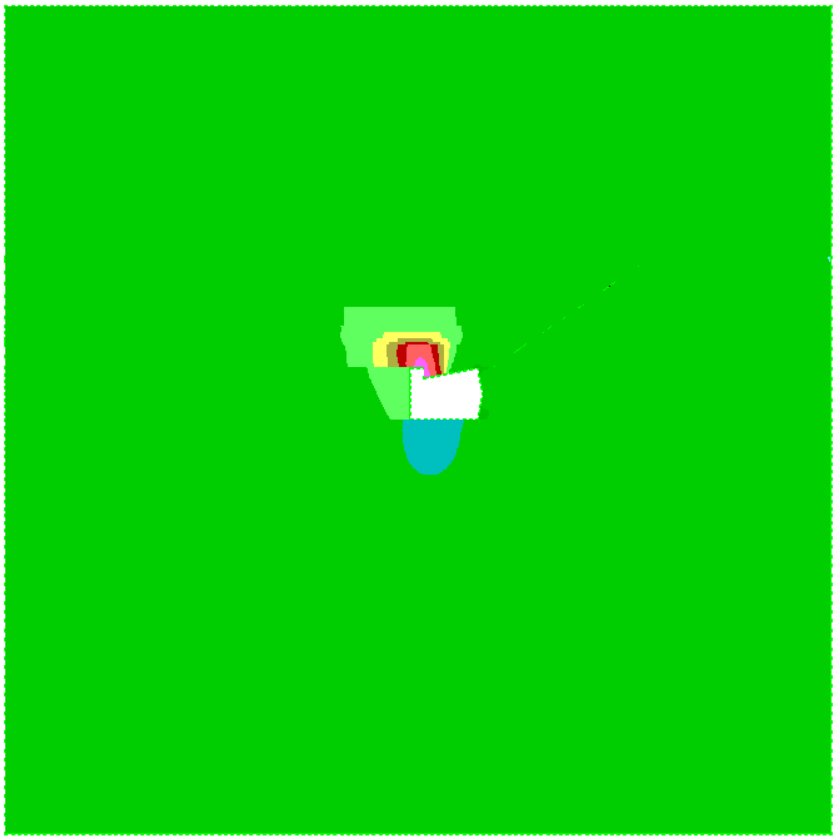
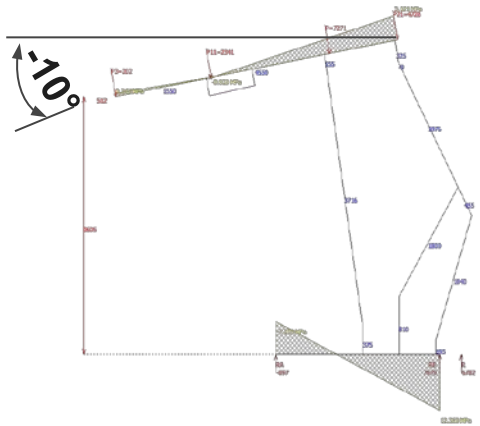
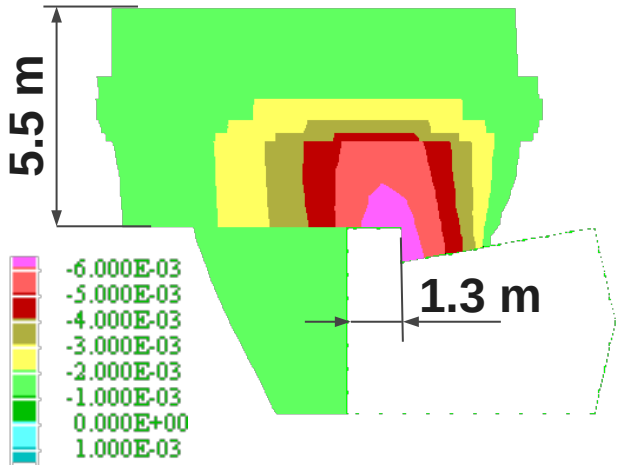
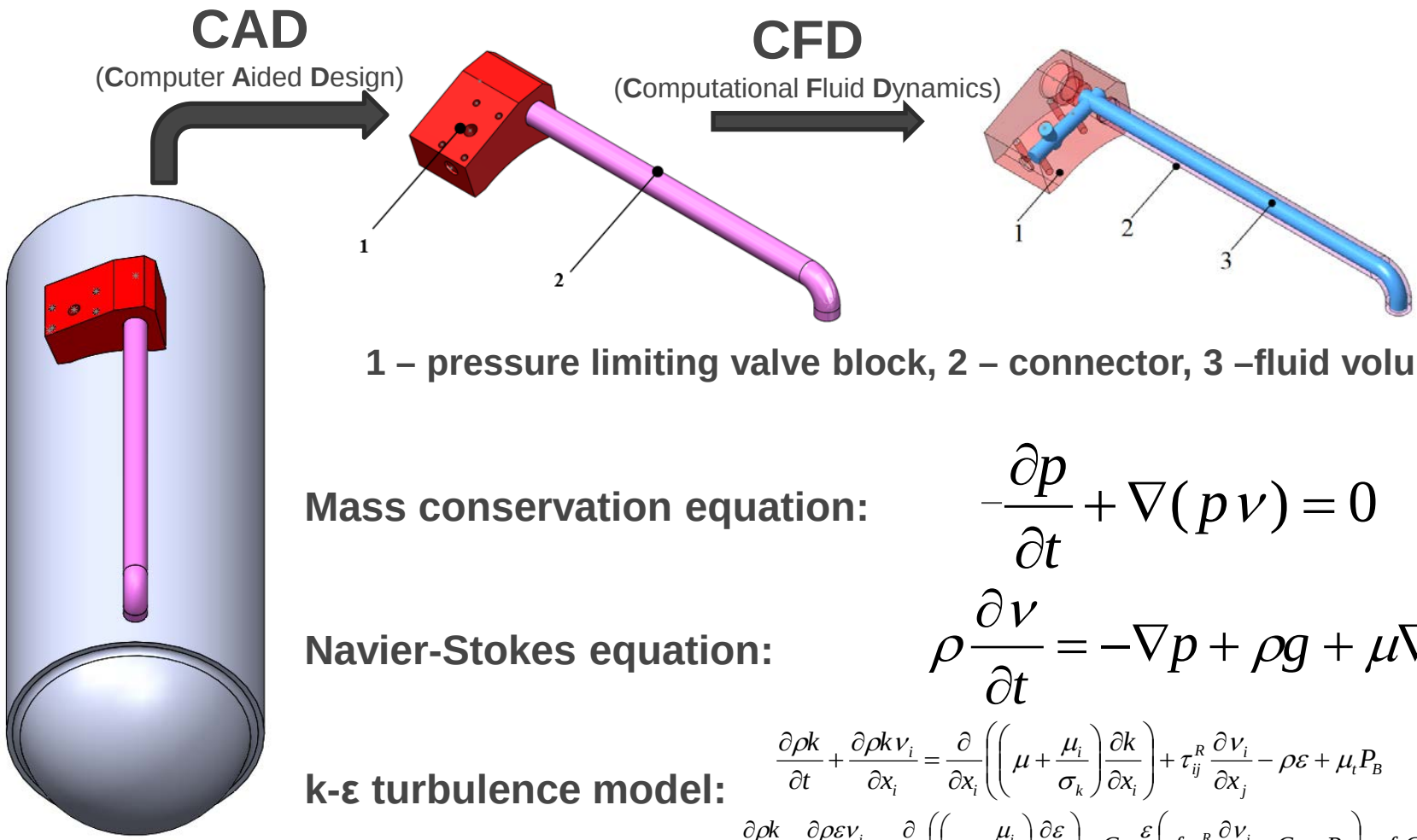






Displacement
SI unit: [m]

Hydraulic supply and control system modelling



1 – pressure limiting valve block, 2 – connector, 3 –fluid volume

Mass conservation equation:

$$-\frac{\partial p}{\partial t}+\nabla(p\nu)=0$$

Navier-Stokes equation:

$$\rho\frac{\partial \nu}{\partial t}=-\nabla p+\rho g+\mu\nabla^2\nu$$

k-ε turbulence model:

$$\frac{\partial \rho k}{\partial t}+\frac{\partial \rho k \nu_i}{\partial x_i}=\frac{\partial}{\partial x_i}\left(\left(\mu+\frac{\mu_i}{\sigma_k}\right)\frac{\partial k}{\partial x_i}\right)+\tau_{ij}^R\frac{\partial \nu_i}{\partial x_j}-\rho\varepsilon+\mu_t P_B$$

$$\frac{\partial \rho k}{\partial t}+\frac{\partial \rho \varepsilon \nu_i}{\partial x_i}=\frac{\partial}{\partial x_i}\left(\left(\mu+\frac{\mu_i}{\sigma_k}\right)\frac{\partial \varepsilon}{\partial x_i}\right)+C_{\varepsilon 1}\frac{\varepsilon}{k}\left(f_1\tau_{ij}^R\frac{\partial \nu_i}{\partial x_j}+C_B\mu_t P_B\right)-f_2 C_{\varepsilon_2}\frac{\rho\varepsilon^2}{k}$$

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Hydraulic supply and control system modelling