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Exercise 1 - Numerical methods for fluid-structure interaction (Summer term 2015)

Exercise 1.1: Recapitulate the three mostly-used types of partial differental differential equations (PDEs); namely elliptic, parabolic and hyperbolic PDEs.

1. State each strong form including boundary and initial conditions
2. What are possible further properties?
   (Hint: maximum principles, etc.)
3. Assuming appropriate functional spaces, what are the corresponding weak formulations of the above equations?

Exercise 1.2: Briefly recapitulate / brain-strom possible consequences on numerical discretization (time and space) of the above types of equations.
(Hint: implicit or explicit time-stepping schemes, stability, etc.)

Exercise 1.3: Let $F(t) \in \mathbb{R}^{d\times d}$ and invertible. Furthermore, let $t \mapsto F(t)$ be continuously differentiable. Show that

$$D_t \det\, F(t) = \operatorname{trace}\big(F^{-1}(t) D_t F(t)\big) \det\, F(t)$$

holds true.

Discussion of exercises: Apr 20, 2015