# Partitioned analysis of dimensionally-heterogeneous models for the Navier–Stokes equations

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**Abstract**

In this work an iterative procedure is developed to tackle the problem of strong coupling of dimensionally-heterogeneous models in fluid mechanics. The procedure proposed here makes use of a reinterpretation of the problem as a partitioned problem yielding a system of non-linear equations in terms of interface variables, for which classical non-linear solvers are applied. The goal is to couple different mathematical models, which can be treated as black boxes, through the imposition of proper boundary information at the coupling interfaces. The main application for which this strategy is envisaged arises when addressing the interaction between hydraulic components which aim at retrieving information from different geometrical scales in complex hydraulic systems. The specific examples are provided in the context of coupling 0D lumped equations and 2D/3D Navier–Stokes equations. The potentialities and the performance of the strategy are shown through several examples involving transient flows.

*Key words:* Strong coupling, Partitioned analysis, Dimensionally-heterogeneous models, Incompressible flows.

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