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# HYBRID ANALYTICAL-NUMERICAL METHODS IN STRUCTURAL AND FLUID DYNAMICS, AND HEAT AND MASS TRANSFER

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## ABSTRACT

Many physical phenomena of paramount importance in the engineering areas of structural dynamics, fluid dynamics and heat and mass transfer are mathematically described by initial- and boundary-value problems. Nowadays, each of different area has its own preferred approach to tackle the formulated initial- and boundary-value problem. However, in many situations, the coupling among different phenomena becomes unavoidable for an accurate thorough description of the problem at hand; hence, mathematically rigorous schemes implemented in a systematic and unified manner are naturally preferred. Despite the extensive progress achieved by purely numerical methods, analytical-type approaches have also been progressively advanced, unified and formalized by a few research groups, in part motivated by offering benchmark results for validation and calibration of purely numerical schemes. Until the end of 1970's, analytical approaches based on integral transforms and eigenfunction expansions (commonly referred to as modal analysis for the solid mechanics community) were widely used to provide exact analytical solutions for many elasticity and vibration problems in bars, beams, shafts, membranes and plates. With the advent of modern digital computers and of the finite element method, modal analysis has been progressively falling into disuse for the solid mechanics community. On the other hand, hybrid analytical-numerical methods have advanced for the past few decades for solving convection-diffusion problems, with particular emphasis on heat and mass transfer applications. Nowadays, some of these methods have been formalized and unified in a systematic manner that may handle problems from distinct engineering areas. In addition, with the advent of symbolical computation, these methods have become even more powerful, and also more accessible for the general user. This mini-symposium will thus focus on hybrid analytical-numerical methods for solving complex initial- and boundary-value problems for structural, fluid dynamics, and heat and mass transfer applications, with particular emphasis multi-physics problems.