XII International Conference on Coupled Problems in Science and Engineering, COUPLED 2027
June 27-30, 2027, Palma de Mallorca, Spain

ALGORITHMS AND ANALYSIS FOR SOLUTION OF INTERFACE-COUPLED PDES FOR DIGITAL TWINS

PAUL A. KUBERRY[*], IRINA TEZAUR[†]

[*] Center for Computing Research, Sandia National Laboratories
Mailstop 1320, PO Box 5800, Albuquerque, NM 87185-1320
pakuber@sandia.gov

[†] Computation & Analysis for National Security
Box 969 Mail Stop 9060, Livermore CA 94551
ikalash@sandia.gov

ABSTRACT

Digital Twins (DTs) increasingly rely on *composed* models, i.e. systems assembled from many interacting components, where each component may be represented at a different fidelity and even by a different mathematical model class. A key emerging need is the ability to couple **reduced-order models (ROMs)** defined on **subdomains or components** in a way that is stable, accurate, and computationally efficient, while still enabling uncertainty quantification, calibration, and data assimilation.

This minisymposium will bring together researchers developing the **analysis and algorithms for coupling reduced order subdomain models**, including domain decomposition-inspired ROM coupling, interface/port methods, projection and constraint-based formulations, and hybrid FOM–ROM couplings. Emphasis will be placed on novel approaches and the mathematical foundations that ensure well-posedness, stability, conservation, and error control across interfaces and across differing fidelities and time scales. Contributions are also welcomed on practical implementations and software support that enable robust, scalable coupling of heterogeneous reduced models in DT workflows.