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Hidden Species in Passive and Reactive Transport Equations: An On-the-fly Reduced Order Modeling Strategy DONYA RAMEZANIAN, HESSAM BABAEE, University of Pittsburgh — This presentation addresses one of the principal barrier in developing accurate and tractable predictive models in turbulent reactive flows which is solving large number of chemical species that can be computationally impracticable. We present an *on-the-fly* reduced order model, inspired by the dynamically bi-orthonormal decomposition (DBO) to solve reactive flow as well as passive scalar problems. The presented approach seeks a low-rank decomposition of the species to three time-dependent components: (i) a set of orthonormal spatial modes, (ii) a low-rank factorization of the instantaneous species correlation matrix, and (iii) a set of uncorrelated species. In the proposed approach, unlike data-driven dimension reduction techniques, there is no need to solve the full-dimensional species to generate high-fidelity data. Instead, the low-rank components are directly extracted from the species transport equation and closed-form evolution equations for the three components are derived. The time-dependence of the three components enables an on-the-fly adaptation of the low-rank approximation to transient changes in the species.

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