Abstract

RBniCS [1] is a python-based library, developed on top of FEniCS [3], aimed at the development of reduced order models in the FEniCS environment. In particular, reduced order techniques such as the certified reduced basis method and proper orthogonal decomposition-Galerkin methods are implemented. The RBniCS project allows RBniCS to take advantage of the high-level (e.g., human readable) code used for the automated solution of partial differential equations. Thanks to the features of FEniCS the final user needs to prepare a short code to carry out a reduced order simulation. It is ideally suited for novice users willing to learn reduced basis methods and reduced order modelling, thanks to an object-oriented approach and an intuitive and versatile python interface. Indeed, it is a companion of the introductory reduced basis hand- book [2], and has been already used in doctoral classes within the ‘Mathematical Analysis, Modelling, and Applications’ PhD course at SISSA, as well as for courses within the ‘Master in High Performance Computing’, jointly offered by SISSA and International Centre for Theoretical Physics (ICTP).

Tutorials 1 and 2: basics

class MyProblem(EllipticCoerciveRBBase):
    def __init__(self, V, subd, bound):
        # constructor ...

    def compute_theta_a(self):
        return self.EIM_obj.compute_theta_a()

def assemble_mu_independent_interpolated_function():
    return all_F

Tutorials 3 and 4: geometrical parametrization

# Assemble

class MyProblemWithSCM(EllipticCoerciveRBBase):
    def __init__(self, V, subd, bound):
        # constructor ...

    def offline(self):
        # Perform first the SCM offline phase, ...

    def get_alpha_lb(self):
        return self.SCM_obj.get_alpha_LB(self.mu)

Tutorials 4: stability factor by SCM

class MyProblemWithEIM(EllipticCoerciveRBBase):
    def __init__(self, V, subd, bound):
        # constructor ...

    def offline(self):
        # Call EIM ...

References

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RBniCS–reduced order modelling in FEniCS
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