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CONCRETE FAILURE ANALYSIS WITH VIRTUAL ELEMENTS AND INTERFACES

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Abstract. The use of multiscale schemes for computational assessments of composites materials has become a promising topic to evaluate the complex degradation mechanisms at different scales of observations. In complex heterogeneous media the effects of these subscales degradation processes affect the macroscopic response behaviour. In the framework of standard numerical analysis procedures, both concurrent and semi-concurrent multiscale procedures were considered so far for analysing failure behaviour of quasi-brittle materials. When it comes to composite materials such as concrete, which are characterized by inclusions or aggregates that are strongly heterogeneous with respect to size and geometry, it is necessary to consider the mesoscopic scale, since it seriously affects the macroscopic response behaviour. However, there are well-founded questions about the capabilities of standard finite element procedures to represent heterogeneous mesoscopic structures, such as concrete, because they impose geometric constraints and unrealistic boundary conditions that distort the resulting numerical solutions. In this work a new approach is pursued for to model the multiscale behaviour of concrete failure mechanisms. This is based on combining Virtual Elements and interfaces in the framework of the discrete approach. VE allow to discretize the domain into arbitrary polygons providing effective and realistic approximations of the concrete large and medium size aggregates while the interfaces facilitate the development of discrete cracks through aggregate-mortar and mortar-to-mortar joints during the loading procedures.