CAD, FEM and IGA
Motivated by the synthesis of computer aided design (CAD) and the finite element method (FEM), isogeometric analysis (IGA) has been developed, which employs the same smooth functions used for geometry (non-uniform rational B-splines (NURBS), T-splines, etc.) as basis functions for analysis [2]. This unification simplifies considerably the design-through-analysis process. Moreover, isogeometric analysis provides a powerful methodology for more accurate solutions of PDEs.

Applications of isogeometric analysis at TU/e include
- Higher-order gradient damage models [5];
- Phase-field fracture mechanics [1] (see Fig. 1);
- Evolving interface / free-boundary problems [4].

Adaptive mesh-refinement
To increase the efficiency of a computation, one performs adaptive mesh-refinement by locally refining the mesh where errors are large; see Fig. 2. In a spline-based mesh, this results in T-junctions giving rise to T-spline shape function.

Challenges for graduate students
Several projects are available on adaptive isogeometric analysis:
- Innovative refinement schemes for multivariate (3D) T-splines;
- Rigorous adaptive (h-p-k) strategies using T-splines [3];
- Robust error estimation and adaptivity for phase-field fracture mechanics [1].

Student profiles
Projects are open to MSc students enrolled in any of the following programs:
- MSc CEM, TFE or MuNT @ Mechanical Engrg.
- MSc CASA / CSE @ Math. & Comput. Science
- 3TU MSc Fluid & Solid Mechanics

For more information, taylor-made projects and further project opportunities contact one of the involved project members listed above.

References