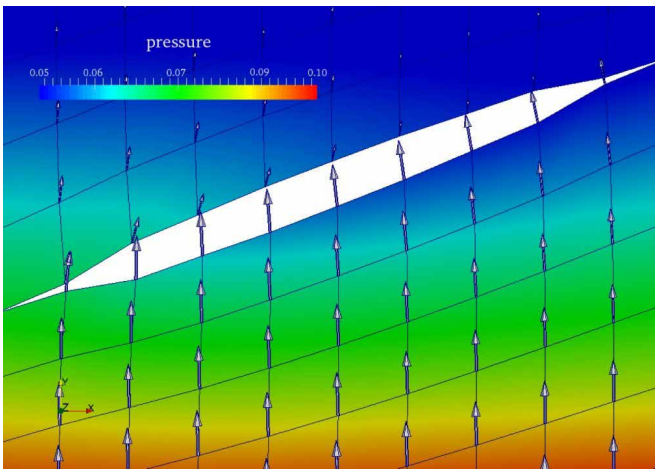
SPLINES FOR DISCRETE CRACK PROPAGATION IN A FLUID-SATURATED POROUS MEDIUM

Prof. Dr.ir.Dr.h.c. René de Borst

(University of Sheffield, UK)

29.06.2018 –
11:00 – IC 03-604



Recently, isogeometric analysis has also been used for the analysis of crack propagation, also for discrete approaches. An elegant approach is to exploit the flexibility of NURBS (and T-splines) in increasing or lowering the order of continuity, which can be carried out in the parameter domain [1]. While this facilitates the introduction of discontinuities, it puts some restrictions on the direction of crack propagation.

Apart from isogeometric interface elements, Powell–Sabin B-splines have been investigated to model discrete crack propagation [2]. Different from NURBS and T-splines, this spline technology is based on triangles. Another difference is that the crack is now directly introduced in the physical domain. Since triangles and Bézier extraction are used, re-meshing is straightforward, and standard algorithms can be used for this purpose.

Different from smeared approaches, discrete crack modelling allows for the straightforward description of mass transport in cracks, as for instance occurs in a fluid-saturated porous medium. A multiscale model is derived. The resulting two-scale model imposes some requirements on the interpolation of the displacement and the pressure fields, which can be satisfied elegantly using spline basis functions [3].

References

[1] Verhoosel, CV, Scott, MA, de Borst, R, Hughes, TJR. An isogeometric approach to cohesive zone modeling. Int. J. Num. Meth. Engng. 87 (2011) 336 – 360.

[2] May, S, de Borst, R, Vignollet, J. Powell-Sabin B-splines for smeared and discrete approaches to fracture in quasi-brittle materials, Comp. Meth. Appl. Mech. Engng. 307 (2016) 193 – 214.

[3] J. Vignollet, S. May, R. de Borst, Isogeometric analysis of fluid-saturated porous media including flow in the cracks, International Journal for Numerical Methods in Engineering 108 (2016) 990 – 1006.

Guests are welcome!