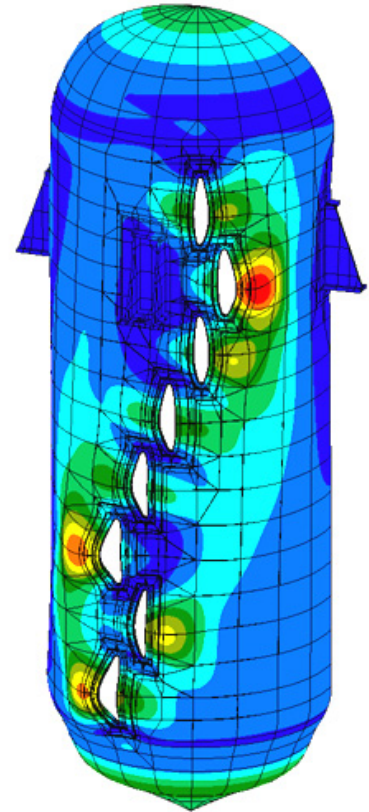


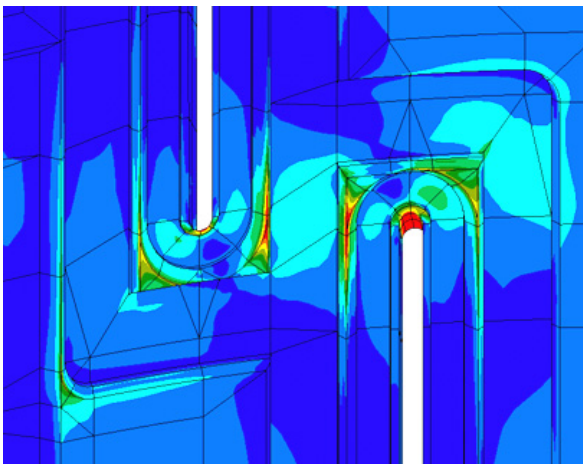
## **FATIGUE ASSESSMENT OF BATCH EXTRACTION TANK**

The standard aspects of pressure vessel design are fully covered by design-by-rule methods and do not generally present overt difficulties to the designer. However, there are occasions in which process or other operational requirements dictate the inclusion of atypical features which cannot be adequately addressed by basic Code rules and which may, therefore, fall outside the capabilities of the designer. In such circumstances a number of clients have made recourse to FCL's services in order to provide the required degree of confidence in the adequacy of their proposed designs.

One such example involved the design of a Batch Extraction Tank for installation at an Irish pharmaceutical plant. The vessel was generally of fairly standard design, but in order to allow simple visual review of the contents level it had been provided with two arrays of sight glasses which extended over almost the complete length of the cylindrical shell. These sight glasses were proprietary items, with a pad-type connection containing a narrow slit-like opening measuring approximately 500mm in length. Following leakage of the sight glasses during initial hydrotest of the vessel, additional reinforcement had been added around each of the sight glass connections in the form of external pads, but concerns remained about the integrity of the design, particularly regarding the potential for premature fatigue failure due to pressure fluctuations associated with operation of the vessel.



Both the geometry and the position of the sight glasses prevented the application of design-by-rule methods and therefore a design-by-analysis approach was adopted to substantiate the design, based on the results of linear elastic stress analysis carried out using Pro/MECHANICA (now CREO/Simulate) finite element software. Fatigue assessment was performed in accordance with methods given in ASME Section VIII Division 2 and successfully confirmed the adequacy of the sight glass design for the defined cyclic duty.



With the aid of FCL's formal report, our client was subsequently able to gain third-party approval for the design and confidently put the vessel into service.