I. INTRODUCTION
Threaded connections are employed during the completion of gas and oil wells to connect casing and tubing. API standards are consulted to evaluate the structural integrity of coupling designs. These design formulas have been validated by a wide range of experiments and conservatism was built in using safety factors. However, due to the introduction of additional geometric features such as a torque shoulder and sealing surface, the formulas have become excessively conservative. New design guidelines need to be defined in order to obtain a safe and optimized coupling for stated load conditions.

II. METHODOLOGY
In order to analyze the effect of the geometric features of thread, shoulder and sealing surface on structural integrity, a parametric finite element model (controlled by python scripting) is developed. It allows assessing the structural behavior of the coupling under combined axial load, bending and internal and external pressures, and isolating the effect of various parameters. In addition to the overall structural integrity, performance criteria such as the distribution of the global load over the individual threads, and the distribution of contact pressures at the sealing surface can be extracted and used to quantify the effectiveness of the coupling.

To validate the developed model, an experimental test setup will be designed and a variety of small scale tests (pipes with an outer diameter (OD) of approximately 30 mm) and large scale tests (OD 140 mm) will be conducted. The setup will allow a combined loading consisting of axial force and fluid pressure.

III. CONCLUSIONS
Based on the experimentally validated simulations, new performance formulas describing the structural integrity of the coupling will be formulated. Furthermore, the parameter study will identify the influence of the individual geometric features. Such information can be used to optimize a coupling’s design, resulting in a more material-efficient but still robust and safe design.