

OPTIMISATION PROCEDURES FOR SEALS DESIGN SELECTION

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SUMMARY

Traditionally, the trial and error method for the development of new designs has been widely used. The quality and reliability achieved in the product fundamentally depended on engineer's experience. Currently, computer-based simulations combined with the usage of optimisation techniques is used extensively in engineering during the design phase to obtain high quality products in a competitive period and cost. The new methodologies allow to the engineers by means of automating the design process using numerical simulations predicting product performance characteristics and specifying goals and constraints of the problem, to increase the evaluations on the product, to analyse multiple design alternatives and to acquire greater product knowledge.

In this way, the main objective of the carried out study is the development of a numerical methodology which can help to the design process to improve the mechanical and tribological behaviour of rubber seals in hydraulic applications, exploring the design space and optimising the best design that meets requirements. The methodology is based on combining FE simulations of the seal using the ABAQUS software and optimisation methods and algorithms implemented in the commercial software Isight for Abaqus.

The first step of the methodology consists on calculating by means of FE simulation the component to analyse and determine the design variables affecting the seal behaviour under high-pressure conditions. The second step has as main objective to generate an automated design strategy for the seal design (mechanical and tribological) improvement. For that, the next steps are carried out:

- *DoE approach: to analyse the sensitivity of the design attributes, identify the critical factors and define an initial design.*
- *Approximation generation: to built a mathematical model of the relationship between sets of inputs and outputs to reduce the evaluation time required for next analysis.*
- *Optimisation approach: to improve the design performance.*

Finally, the third step allows to characterise the reliability and robustness of the design by means of "design for six sigma" tools.