Modeling a drum motor for illustrating wearout phenomena

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In this contribution, a model of a drum motor is presented. This model was designed for description of dynamic behaviour of the drum motor as well as for the possible implementation of several wearing phenomena. Using this model, a better understanding of wear and tear phenomena has been achieved by carrying out a considerable number of simulation runs using different operational and wearing conditions. Using this information, important knowledge about detection of wearout signs was able to be gained.

Mathematical models help to increase the understanding of physical properties of a system. Often, mathematical models with different levels of detail are used. In these cases, it may be a difficult task to obtain reliable parameters. In this paper, we present three different approaches for establishing a model structure and for the determination of needed parameters. Some of them we were able to calculate while other ones we were only be able measured. Calculation was performed analytically or by using a Finite Element model. This way, we were able to define every part of the model with an appropriate level of detail and equip them with adequate parameter values.

The main components under investigation are roller bearings, O-rings, and a one-stage gear. We integrated all three partial models into one Modelica model of the complete system. Using this model we carried out simulation investigations of wear and tear phenomena. Hence, get experiences in predicting the behaviour of a worn system within its usual environment. This opens the possibility to investigate some consequences of wearout effects in several simulation runs in order to establish design rules for condition monitoring algorithms and thus support the development of adapted condition monitoring systems.

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