

# Modeling different structures and verifying models from a system view with window regulators as examples

Xin Zhao<sup>1</sup>, Sergey Petkun<sup>1</sup>

<sup>1</sup>Brose Fahrzeugteile GmbH & Co. Kommanditgesellschaft, Hallstadt, Max-Brose-Straße 2, D-96103 Hallstadt

As the development of automobile industry, window regulator has evolved from manual window regulator to power window regulator with intelligent control. At present window regulator has turned into a complex mechatronic system. The electrical window regulator in a car is a classical example of mechatronic systems, because it contains all necessary components of mechatronic systems. With growing complexity from one hand and price pressure from the other, it is almost impossible to develop such system without good assistant tools. The system simulation helps to overcome the difficulties arising with requirements on market, such as shortening development time and decreasing its cost. In this paper it is shown how two different types of window regulators can be modeled using a uniformed way. A cross arm window regulator and rail guided cable driven window regulator are based on different working principles. And the great difficulty is to model both types in the same simulator platform. The both systems share the same functionality, although they are fundamentally based on different mechanical solutions. The ranges of working conditions of both systems are so wide that it leads to natural desire to replace numerous tests with modeling. The generalized approach for modeling such systems is discussed and the verification of models is introduced, which is to compare simulation result with simultaneous paralleled measurement from physical window regulator systems. A very important question is discussed how detailed models should be built.