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## **USE OF A VIRTUAL PRODUCT ENVIRONMENT FOR AXLE SUSPENSION SYSTEM DEVELOPMENT AND JOINT ANGLE CALCULATION**

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### **KEYWORDS**

Virtual Product Environment, suspension, optimization, axle characteristics, joint angle calculation

### **ABSTRACT**

Ever shorter times to market and increasingly exacting requirements for chassis system functionality necessitate an efficient and intelligent development process. Careful advanced development ensures that limiting parameters are integrated at an early stage and that conditions for subsequent development can be posited rapidly and reliably.

“ZF Lemförder Fahrwerktechnik” and “Institut für Kraftfahrwesen Aachen (ika)” have jointly elaborated a calculation tool known as ABE for use in suspension development, including kinematic design for axle systems. The tool is modular and has been extensively optimized over an extended period of time. A proven, standalone development tool that enables rapid kinematic analysis and axle design, ABE has now been extended by a module for calculating the joint angles of ball joints and bushings for rigid kinematic axle system movements. The new joint angle module evaluates and visualizes relative joint positions during axle system movement sequences with two degrees of freedom for spring movement and steering movement. The mathematical model and specimen results are described, as is the integration of ABE and its modules into the overall virtual product environment at ZF Lemförder Fahrwerktechnik. The entire suspension development process is realized in this environment, including syntheses of multibody systems (MBS), CAD systems and finite element methods (FEM).