

## The model of wheel-surface interaction for all terrain vehicle dynamics simulation

**Tomasz Czapla, Mariusz Pawlak**

*Abstract:* In this paper the new methodology of wheel-surface interaction numerical simulation is presented. The finite element method is combined with discrete element method, rigid body dynamics and advanced wheel-surface friction model. Compared to current state of art the novel approach is more realistic traction force application in the contact surface between wheel and soil. Rotation of non-driven wheel is the effect of axis movement and mentioned contact forces. Developed method allows to assess longitudinal and lateral forces for wide range of attack angle of the wheel. That is essential for skid-steered vehicles traction effort calculations. The paper presents current results of numerical calculation that are intended to complement the test results and develop the ground-tire interaction models. Therefore, the novel approach for traction effort for off-road vehicles is being developed through a combination of experimental laboratory and field tests with numerical calculation results. The proposed method will be implemented in the analysis software dedicated to fast calculation of traction effort for skid-steered off-road vehicles to optimize the transmission system. Based on the experimental research, a need appeared to create a numerical model and to describe the contact phenomenon between the wheel and the ground as faithfully as possible. In this publication, the novel approach is the manner of comparison of the experimental research results with a numerical simulation using the discrete and finite element methods in the LS-DYNA software.

---

<sup>1)</sup> Tomasz Czapla, Ph.D.: Politechnika Śląska, Akademicka 2A, 44-100, Gliwice, Poland (PL),  
Tomasz.Czapla@polsl.pl .

<sup>2)</sup> Mariusz Pawlak, Ph.D.: Politechnika Śląska, Akademicka 2A, 44-100, Gliwice, Poland (PL),  
Mariusz.Pawlak@polsl.pl .