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CORRECTION OF WAVE RISE EFFECTS FOR HIGH-SPEED FULL-SCALE MODEL DITCHING OF GENERIC FUSELAGE SECTIONS

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A ditching analysis is requested by the authorities for the certification of civil aircraft. In order to support the aircraft manufacturers on the optimisation of approach and impact conditions and the structural strengthening, the simulation method *ditch* has been developed [1] and continually improved [2]. The 2D+t method *ditch* delivers a reliable and computationally efficient approach for the prediction of ditching loads on the aircraft structure. Ditching hydrodynamics refers to violent flows, is prone to scale effects and involves significant fluid-structure-interaction. Therefore, the analysis should be based on simulation tools for a safety compliant aircraft design. During the former FP7 founded European SMAES project (SMart Aircraft in Emergency Situations) CNR-INSEAN conducted experiments with generic aircraft hull sections at high velocity in order to reduce scaling effects. The specimen were catapulted on a guide with up to 45 m/s horizontal and 1.5 m/s vertical velocity at different pitch attitude into the water and experimental results were compared with ditching simulations.

The numerical results from the *ditch* method showed a high agreement with the measured pressure signals apart from time shifts during the immersion of the specimen. Due to the high resistance the vertical velocity of the specimen is deemed to decrease slightly during the impact, whereas the timing of the measured pressure peaks, however, does not increase but decrease. The apparent contradiction can be explained by a wave rise forming in the impact region of the specimen. Considering the wave rise effect the accuracy of the simulation significantly improves. This paper scrutinizes different approaches of the wave rise phenomenon and reports the implementation into the *ditch* method. Computational results will be compared with data from the high-speed ditching experiments and limitations of the applied corrections will be discussed.

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REFERENCES

[1] Söding, H. *Berechnung der Flugzeugbewegung beim Notwassern.* Report No. 602, Hamburg University of Technology, 1999.

[2] Gropengießer, W. and Rung, T. *Computational Modelling of Aircraft Ditching with two-way Fluid-Structure-Interaction.* ECCOMAS Congress 2016, 2016.