Research on the similarity of tire spray caused by rolling in the water and falling into water

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Abstract

The tire spray produced by aircraft running on wet runways may enter the intake of engines, which may lead to the compressor stall, surge, or even flameout. Therefore, it is necessary to do some research work on this problem. Firstly, according to the analysis of the interaction between tire and water, the similarities of the spray generation and propagation by tire rolling in the water and tire falling into water are proposed based on combining the strip method with the fluid similarity theory. Then the numerical models of an aircraft tire rolling in the water and falling into water are established by coupled smoothed particle hydrodynamics (SPH) and finite element method (FEM) in LS-DYNA software. According to the numerical results, the mechanism of the side spray is proposed. The front views of the side plume in these two spray systems are compared to certify the similarity. At last, the test of tire falling into water is recommended to investigate the basic phenomenon of aircraft tire spray based on this kind of similarity.

Keywords: aircraft tire, spray, SPH, strip method, fluid similarity theory