عنوان مقاله:

A Unified Transformation Framework for Studying Various Situations of Vertical/Oblique Drop Impact on Horizontal/Inclined Stationary/Moving Flat Surfaces

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خلاصه مقاله:

There are various situations of drop impact on solid surfaces widely occurred in natural phenomenon or used in different industrial applications. However, comparing and classifying these drop impact situations is not easy due to different states of the parameters affecting drop impact dynamics. In this article, a unified transformation framework is proposed to study various situations of vertical/oblique drop impact on horizontal/inclined stationary/moving flat surfaces with/without a crossflow. This simple framework consists of a coordinate with normal and tangential axes on a horizontal stationary surface. For each drop impact situation, the drop velocity, gravitational acceleration, possible induced flow due to the moving surface, and possible crossflow are transformed into the framework. Comparing the transformed versions of considered drop impact situations facilitates identification of their physical similarities/differences and determines which situations (and under what conditions) lead to identical results and can be used interchangeably. Although common situations of drop impact on moving surfaces (having tangential component of surface velocity) lead to asymmetric drop spreading, the possibility of symmetric drop spreading on moving surfaces is demonstrated and analyzed using the proposed transformation framework. This interesting possibility means that for related production lines or experimental setups, where symmetrical drop spreading is required, the surface does not need to be stationary. In such applications/setups, the use of moving surfaces (rather than stationary surfaces) can considerably accelerate the symmetric drop impact process. Our simulation results of several of the considered drop impact situations well confirm the facilities/predictions of the proposed transformation framework.

کلمات کلیدی:

Drop impact on flat surfaces, Symmetric drop spreading on moving surfaces, Unified transformation framework, Accelerating drop impact process, Fast production lines