

ALE finite element simulation of impact force from a sphere dropped in air

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ABSTRACT

In order to evaluate impact forces by flying debris through a fluid-structure interaction analysis of the debris motion and surrounding fluid motion, a numerical procedure to handle the process of impact is investigated. The objective model problem is that a sphere falling in a still air hits the ground.

The numerical flow simulation method employed is the finite element method based on the variational multi-scale method. The ALE method is applied to treat the moving mesh around the sphere. The impact force is applied to the equation of motion of the sphere. The amount of the impact force is determined by giving the condition that the velocity of the sphere has to be zero at the impact.

This procedure is improved to remove unphysical numerical pressure oscillation by subdividing the impact process into multiple fine steps. It is found that the impulse is evaluated in the present procedures. The effect of the mass ratio on the impact process is also investigated.

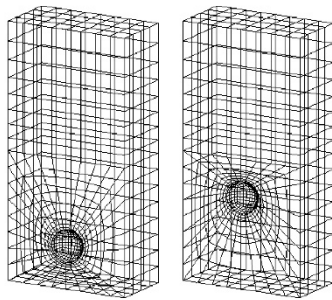


Fig.1 Mesh deformation around moving sphere

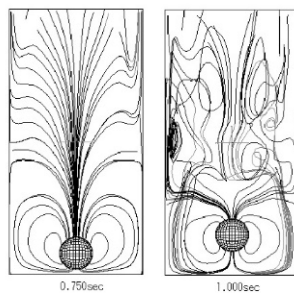


Fig.2 Computed streamlines before/after impact

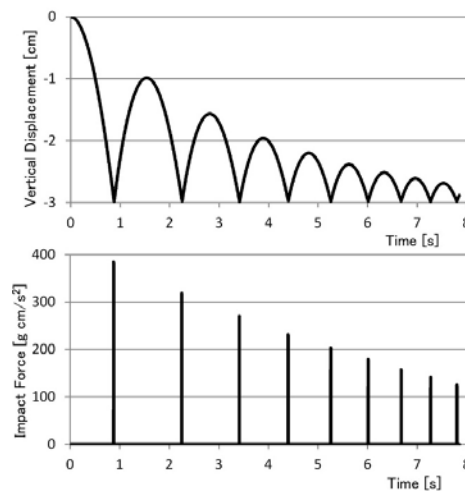


Fig.3 Computed trajectory of the sphere and impact forces

REFERENCES

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