Tohoku Univ. Technology

Distributed micro roughness (DMR) for reducing friction drag

Improving fuel consumption in transportation (Automobiles, aircraft, bullet trains, linear trains, drones, etc...)

Overview

In order to improve the fuel efficiency of aircraft and automobiles, it is effective to reduce the air drag, especially the friction drag, on the surface of airframes and bodies. Riblet is known as a conventional technique for reducing friction drag, but when the direction of stream line deviates from the riblet direction by more than a predetermined angle, the friction drag increases. On the other hand, there are few research examples of sandy rough surfaces (i.e. distributed micro roughness (DMR)) for reducing friction drag.

In addition, there are many simulations focusing on turbulent flow (with high friction drag) over a rough surface, but there are few simulations focusing on the transition from laminar flow to turbulent flow.

The present invention focused on the transition from laminar flow to turbulent flow, and it was clarified that the DMR can delay the transition by suppressing turbulence energy growth and reduce friction drag. Therefore, it is expected that the DMR of the present invention can be applied to the surface of transportation, thereby reducing friction drag and improving fuel consumption. The device may propose a new standard for product surface finishes.

Product Application

- ☐ Improving fuel consumption in transportation (Automobiles, aircraft, bullet trains, linear trains, drones, etc...)
- ☐ Simulation method, device and program for sandy rough surface

IP Data

IP No.	:	JP2023-560283
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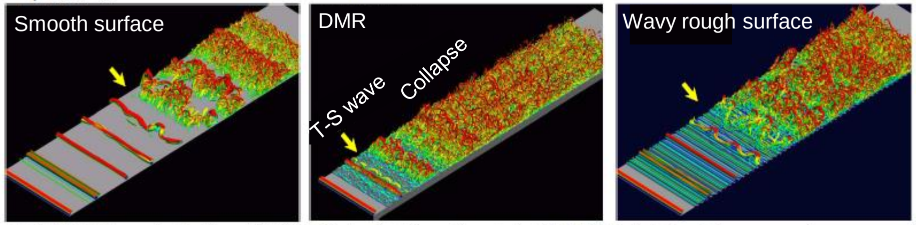
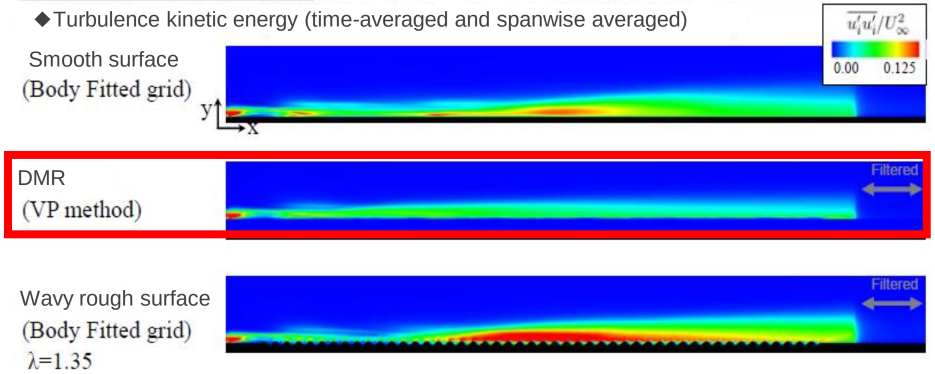
Admin No.	:	T22-118

Suppression of turbulence kinetic energy by DMR

◆Instantaneous field

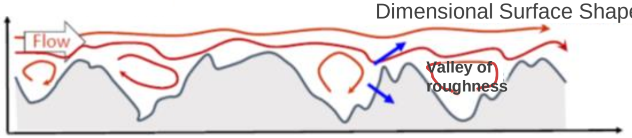


◆Turbulence kinetic energy (time-averaged and spanwise averaged)



Effect of three-dimensional DMR

Velocity Disturbances Generated by Fine, Three-Dimensional Surface Shapes



・Low velocity fluid is confined in the roughness trough, the occurrence of ejection is suppressed, and turbulent kinetic energy is suppressed.

Related Works

[1] Shingo Hamada, Aiko Yakeno, Shigeru Obayashi, Drag reduction effect of distributed roughness on the transitional flow state using direct numerical simulation, Int. J. Heat Fluid Flow, 104, (2023)

Contact

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