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SOFT COMPRESSIBLE POROUS MAT FOR "FLYING" VEHICLES

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Abstract- This paper explores the performance of a flying vehicle on a soft porous blanket at a high speed. The flying vehicle employs the basic principle of lubrication theory. An airplane can fly in air, because air is strong enough to support the airplane. The flying vehicle can also fly on the soft porous blanket if the moving body pushes air in the soft compressible porous mat. A model is established.

Keywords- Model; Porous blanket; High speed road

1. INTRODUCTION

We first consider a moving ski on the soft snow. The snow can not support the weight, but the air in the snow can, the higher speed of the ski, the higher support force, this simple principle can be used to design a flying vehicle on soft porous blanket, and we can use lubrication theory to elucidate the phenomenon[1].

2. FLYING VEHICLE

An airplane can fly in air, because air is strong enough to support the airplane. A car or a train can also fly if the moving body pushes air in a soft compressible porous mat (see Fig.1), which can be nonwoven mat or other porous materials.

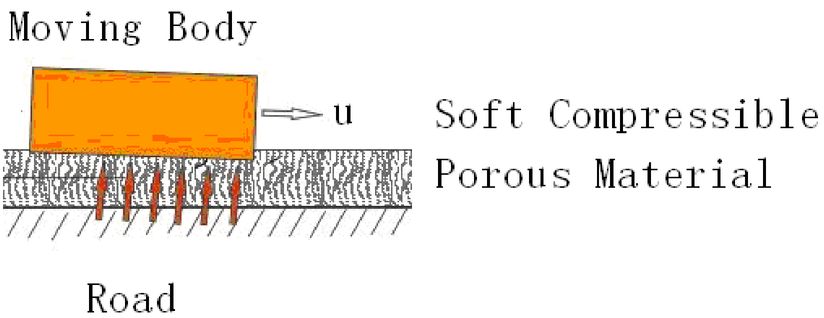

Fig. 1 Flying car on soft compressible porous material

Assume that the speed of the vehicle is u, and the total mass is m, its the contact length is L . The moving vehicle pushes the soft compressible porous mat, which is deformed with a slope of α, the thickness of the porous blanket is h, see Fig.2.

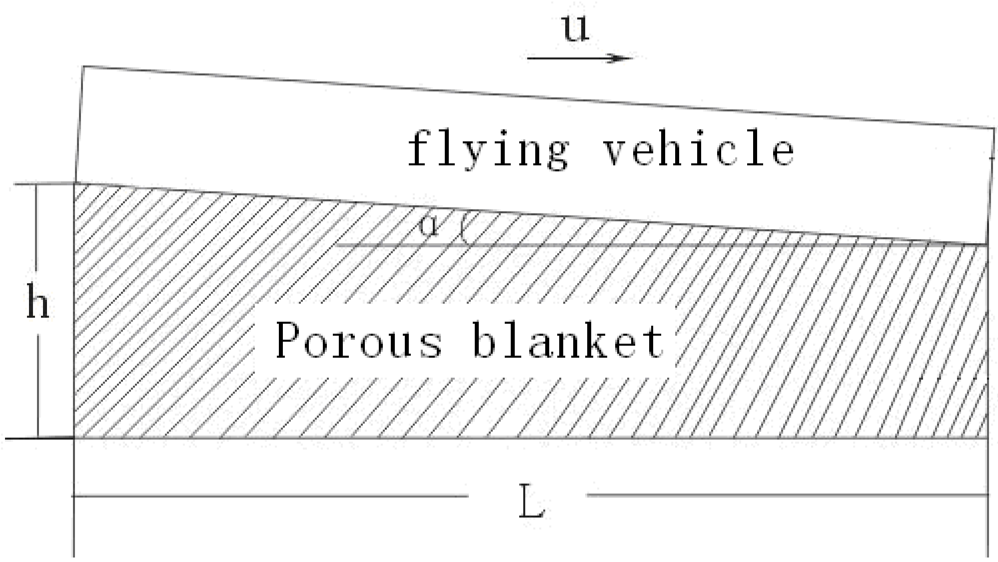

Fig. 2 the schematic diagram that the car is running on the blanket

Using Newton's second law, the motion of the vehicle can be modeled as

$$m\frac{du}{dt} = \int_0^L pS\sin\alpha dx - f_1 - f_2 + \varphi \tag{1}$$

where p is air pressure, S is the contact area between the bottom of the vehicle and the soft porous mat, f_1 is the mat friction on the interface of the vehicle and the mat, f_2 is the air drag, φ is the force acted on the vehicle, it can be power as that in the traditional vehicles or the air jet in airoplane.

We write down the simplest formulations for the friction:

$$f_1 = \mu(mg\cos\alpha - \int_0^L pS\cos\alpha dx) \tag{2}$$

$$f_2 = Cu^2 \tag{3}$$

where μ is the friction coefficient, C is a constant.

In case $\int_0^L pS\sin\alpha dx - f_1 - f_2 \geq 0$, the vehicle can fly without a power supporter.

The air motion in the soft porous mat can be approximately modeled using the Navier-Stokes equation, which is

$$u\frac{\partial u}{\partial x} = -\frac{1}{\theta\rho}\frac{\partial p}{\partial x} + \eta\frac{\partial^2 u}{\partial x^2} \tag{4}$$

Here θ is the porosity ratio, ρ is the air density, η is the viscosity.

According to the lubrication theory, the air pressure gradient in the soft porous mat can be approximately calculated by the following formulation

$$\frac{dp}{dx} = 6\eta u \frac{h - h^*}{h^3} \tag{5}$$

where h^* the mat thickness where the air pressure is maximum.

A more accurate description of air motion in porous mat is the differential-difference equation, see Ref.[2].

From the above equations, the two main variables, the vehicle speed and the air pressure, can be solved.

3. CONCLUSION

We suggest a concept of the flying vehicles, which might be found applications in the near future.

4. ACKNOWLEDGEMENT

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