

振動する円筒の周りの流れについて (その2)

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ON THE WIND STREAM AROUND A VIBRATING CYLINDER (2)

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For several years we have been studying about the vibration of an elastically restrained circular cylinder in wind. To control the oscillation of smoke stacks induced by wind, this kind of the problem is very important and in these years some papers on it have been published but the problem is complicated and the limited data can be obtained at present.

Although the oscillation of stacks in wind is on the problem in the range of supercritical Reynolds' number, it is interesting also to carry out the tests in the subcritical range if the exciting force is only due to the alternative vortex shedding. So in this range we have investigated the alternative lift forces to the circular cylinders which would be affected by the amplitudes and the frequencies of the vibration.

From the experiment we got the results as follows;

1. Through the all range of wind speed 7 m/sec to 20 m/sec, the vibration of the cylinder was caused by the natural frequency.
2. We found one peak point of the amplitude in the range of the wind speed, though there might be more than one over this range. The Strouhal number was about 0.15.
3. The amplitude was nearly sinusoidal and stationary.
4. In the low damping system as in our tests (logarithmic decrement $\delta=0.001\sim0.03$), small change of wind speed near the critical speed influenced its amplitudes sensitively.

We can see that the alternative lift force is approximately sinusoidal from the time variation of the amplitude and if the vibration of the cylinder is a linear system, it is regarded as like as the resonant vibration, because the frequency of external force always coincides with the natural frequency. On the detail of these phenomena we will develop further experiments in near future.