

Visualization and the Tacit Knowledge



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Most mechanical engineers do not like to talk about the philosophy of their work. However, research works based on the flow visualization contain a profound meaning of our brain function. Michael Polanyi (1891-1976), philosopher born in Budapest analyzes how we distinguish a particular person by looking at his or her face in his book entitled "the tacit dimension".

The face consists of parts such as eyes, nose and mouth. Every person has different shapes of these parts. In addition, different persons have different configuration of those parts. It may be possible to compare details of small difference of those parts among different persons and that of the configurations of those parts in a face to describe characteristics of a face with an explicit manner. Polanyi claims, however, that the way of the recognition by our brain does not follow this process.

He tells that we capture the whole characteristics of the face at once without investigating details of the various parts of the face. Rather, it is impossible to reconstruct the face of a particular person only with words. He compares visual information with information given by description with explicit words and says that "we can know more than we can tell". He defined this ability "tacit knowledge".

Most research targets dealt with in this journal are the non-linear system. The flow visualization is a powerful tool for complex flows whose dynamics is not derived analytically from the NS-equation. Then, why can we get an insight for difficult problems from visualized images?

Polanyi considers that a complex system has the multi-level structure. As for the fluid mechanics, the basic equations are the structure in the lowest level. The problem goes higher levels by specification of parameters, boundary conditions, and initial conditions. Complex non-linear flows are located in the highest level. The behaviors of flows in the higher level are controlled by the rules in the lower levels. He called this process "the principle of marginal control". However, the structure in the higher levels is controlled also by the additional rules which cannot be directly derived from the rules in the lower levels. Polanyi thinks that the additional rules appear in a process called "the emergence", extending the concept of the emergence used in the biological evolution. The tacit knowledge plays an important role in the discovery of the additional rules in the higher level which is the main subject of the flow visualization.

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