FOREWORD

Continuity and Discontinuity
— a Problem of Design Concept of Aseismic Structures

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Though the technique of analysis of dynamic response of structures to the earthquake has rapidly advanced since the analysis became mandatory in the design of tall buildings, caution is needed against the tendency of the dynamic analysis being fallen into the stereotype of routine works.

The tall steel buildings recently built have been standing for years without suffering by earthquakes. On the contrary, the Tokachi-Oki as well as the San Fernando Earthquakes, bringing serious damages to reinforced concrete constructions, pushed us forward to the improvement of design method, especially to give more shearing resistance and ductility to the columns in combined compression and bending. Further advancement of the design concept is required in order to overcome the difficulties of mid-height buildings of reinforced concrete and composite structure of reinforced concrete and steel, for which ductility is essential to withstand intensive vibratory response to earthquake.

It is common practice to design buildings for atomic power plants as rigid structures of high natural frequency leading to intensive response to earthquake in contrast with the office buildings which are designed as tall steel frames of low natural frequency. Even though the conditions of social requirements and economical basis are different between atomic plants and commercial buildings, it is strange that the buildings of short and long natural period are practised on different bases of design concept. As there is unlimited variety of structural design, it is undesirable to make discontinuities of the theoretical treatment according to the types of structure. New combination of materials and construction methods creates new types of structures which have appreciable properties in design. Among examples of such structures, there are composite structures of reinforced concrete and steel as well as various structures from prefabricated components which are making noticiable development.

Though we can solve the problems of elastic wave propagation in the underground layers deep enough from the surface, we have to give up to solve the same problems in shallow layers because of

the inelasticity and discontinuity of the surface layers. In order to avoid such difficulties involved in soil mechanics, it is becomming popular to substitute the problems of wave propagation near the surface by problems of damped vibration of spring-mass systems. This is another example of discontinuity of theoretical treatment. Discontinuous way of thinking may be taken as one of the characteristics of engineering practice and progress necessarily accompanies discontinuity. However, from the academic point of view it is desirable to accomplish a unified concept of anti-seismic design of structures which provides us the basis of continuously dealing with various types of structures, from earthdams to prefabricated light steel dwellings or piping systems for heat exchanger.

For a researcher it is his pride to challenge for numerous unsolved problems with a vision of engineering in remote future.

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