Foreword

It was for Bulletin No.9 of 1975 that I was given the opportunity to write the Foreword, so this is the second time for me. During this time, there has been increased concentration of population in urban areas, and social and industrial facilities which are of large scale and require high degrees of precision—for example, information systems—have come to be popularly constructed. The same may be said for seismic active regions. Under such circumstances, it is only natural that the earthquake resistances of these facilities should be considered important along with earthquake prediction, and strong demands have come to be made for studies of the matter to be carried out. It might be said that the impact of earthquakes on the functions of society has greatly increased due to changes which have evolved in society.

Meanwhile, great earthquakes normally occur at intervals of several tens of years, several hundreds of years, or even longer so that to predict earthquakes perfectly is difficult, and in such case, how the earthquake resistances of structures should be evaluated, how the earthquake resistances to be imparted to structures should be rationally determined, and further, how the earthquake resistance should be realized in real structures are fundamental problems. In Japan, where there is much earthquake activity at all times and transmission of earthquake information is good, earthquake countermeasures can continuously be made objects of consideration, but in a region where seismicity becomes active at intervals of say several hundred years, it may be thought that the concept of earthquake resistance will naturally be different. The recent Koyna Earthquake of 1967 and the Tangshan Earthquake of 1976, in which more than 240,000 lives were lost, serve to emphasize the importance of these problems.

In deciding on the earthquake resistance to be imparted, it is not sufficient field of natural science only. Rather, a large proportion will be strongly affected by judgments from a societal point of view. However, evaluation of earthquake resistance and concretization of earthquake resistance are inseparable, and it is a fundamental requirement for these engineering problems to be resolved. The situation at present is that the concept of "Maximum Credible Earthquake, Maximum Design Earthquake, and Operating Basis Earthquake" has been set forth as one way of handling these problems. This concept, which has arisen from an engineering viewpoint, is being used for important structures such as those in nuclear power, but in making determinations, when records of historical earthquakes are lacking, or when long-term records are not available, it is unavoidable for a seismotectonics method to be relied upon, and it is not an easy matter for confirmation to be made. Assuming that the determination is made, when applying it to a structure, concretization must be aimed for based on a perception of the beforementioned earthquake resistance of a structure which is correct, taking into consideration the economic condition. In such case, it is required that proper evaluations be made of the earthquake-resistant strength, stability, and maintenance of functions of the structure or system. Since earthquake motions comprise unsteady and random vibrations, the earthquake-resistant strength of a structure has relations with the dynamic characteristics of materials in the nonlinear domain,

and earthquake input is transmitted to the structure through the ground-foundation system, it is extremely difficult making a correct evaluation.

Prof. G. W. Housner, Dr. X. Liu, Prof. S. Okamoto, Prof. J. Penzen, and Prof. J. Petrovski, who took part in the symposium in 1983 held to mark the occation of ERS member Prof. K. Kubo' s retirement from the University of Tokyo, emphasized in their lectures the importance and necessity of properly grasping seismic force acting on a structure and properly evaluating the earthquake-resistant strength of the structure. It is an extremely difficult task to determine the behavior and strength of a structure at the time of a great earthquake. However, it is felt that the conditions for resolving the problems are beginning to be met with development of various kinds of measuring instruments and the remarkable progress in analysis techniques based on advances made in computers. At such a time it is necessary for even more efforts to be made to obtain actual data on these basic problems in earthquake engineering of grasping the nature of earthquake motions, behaviors of structures during earthquake, and analyzing failure processes. It is thought that by doing so it will become possible to set up earthquake-resistant structures surpassing structures in the past.

"Facilities for Observation and Simulation of Earthquake Motion" have been in operation at ERS from the 1983 fiscal year. This present bulletin is a special issue reporting on studies made with these facilities. It would be gratifying if it were to be of general reference.

Choshiro Tamura
Professor, Institute of
Industrial Science,
University of Tokyo