Appendix D

Facilities and Testing Equipment

D.1 Introduction

The facilities and the equipment used in the tests considered in Chapter 5, are described in this appendix.

The tests were part of the so-called 'Ecoleader Project', sponsored by European Union funds. The tests were carried out at the Laboratory of Structural Dynamics of the Bristol University at Bristol, UK.

D.2 Shaking Table

The laboratory holds a shaking table, which is a 3-meter square aluminum platform which moves by means of hydraulic actuators. This shaking table has 147.1 kN (15 ton) of capacity and 6 degrees of freedom of motion (i.e., two horizontal components, the vertical component and the roll, pitch and yaw rotational components). The operational frequency ranges between 0 and 100 Hz. Fig. D.1 shows a photo of the shaking table. The hydraulic actuators, shown in Fig. D.2, are controlled by computers (see Fig. D.3) and a 64-channel electronic equipment (see Fig. D.4) is available to track down the response of the tested models.

D.3 Instrumentation

The instruments utilized in the tests were: an spectra analyzer, an amplifier, accelerometers, displacement transducers and load cells.

The instrumented rigs are displayed in Figs. D.5 (SSMFD) and D.6 (TSMFD). For the SSMFD, a total of 11 instruments (3 accelerometers on the base center, 2 accelerometers on the top, 2 big-displacement transducers on the top, 2 small-displacement transducers on the FD and 2 load-cells on the braces) were used in the tests. For the TSMFD, a total of 19 instruments (3 accelerometers on the base center, 2 accelerometers on the first floor and

Figure D.1 Shaking-table at the University of Bristol facilities

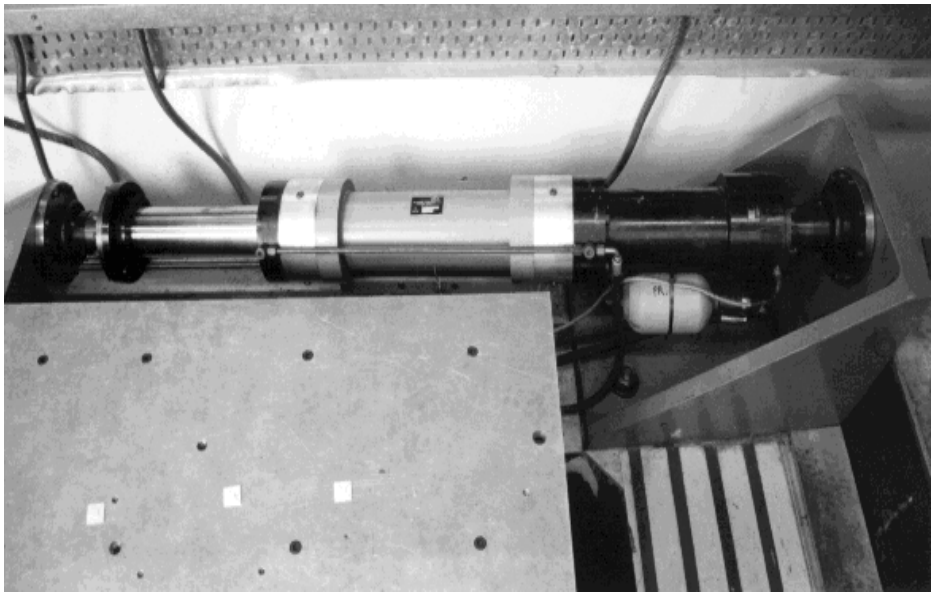


Figure D.2 Hydraulic actuator that moves the shaking-table

Figure D.3 Computer equipment to control the motion of the shaking-table

Figure D.4 64-channel amplifiers

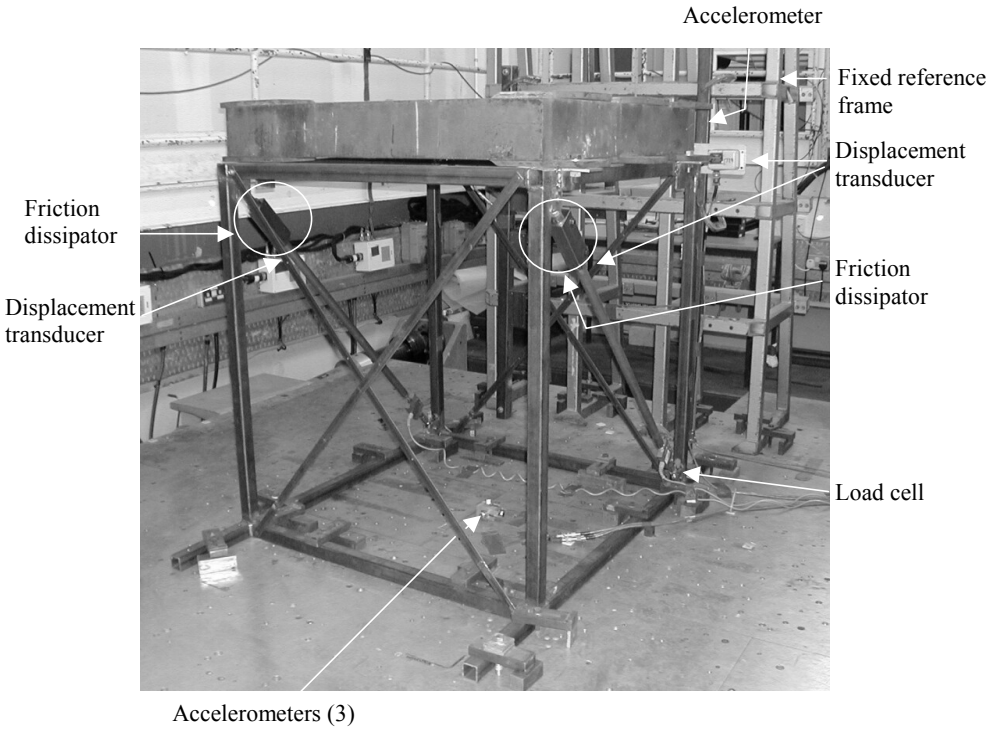


Figure D.5 Instrumentation of the SSMFD

2 on the top, 2 big-displacement transducers on the first floor and 2 on the top, 2 small-displacement transducers on the first-floor FD and 2 on the second-floor FD, and 2 load-cells on the first-floor braces and 2 load-cells on the second-floor braces) were used. The setting of a small-displacement transducer on the FD is shown in Fig. D.7.

D.3.1 Amplifier

An 8-channel amplifier (see Fig. D.8) was utilized to calibrate the displacement transducers and the load cells.

D.3.2 Spectra analyzer

The spectra analyzer, displayed in Fig. D.9 was used to get the frequencies of the models when subjected to white noise signals.

D.3.3 Accelerometer 'Setra'

This accelerometer, shown in Fig. D.10, is a small device that registers absolute accelerations. It was calibrated to give 1 g of acceleration per each volt of input voltage.

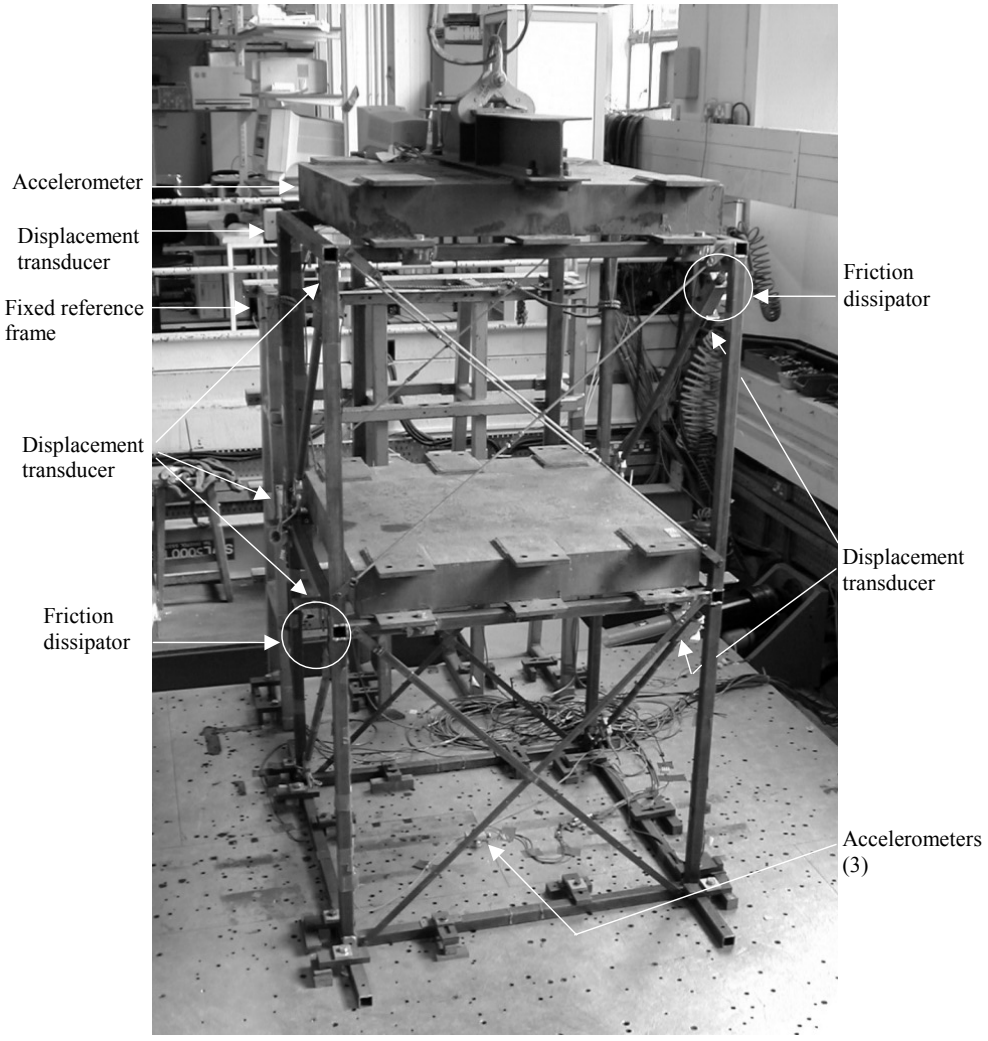


Figure D.6 Instrumentation of the TSMFD

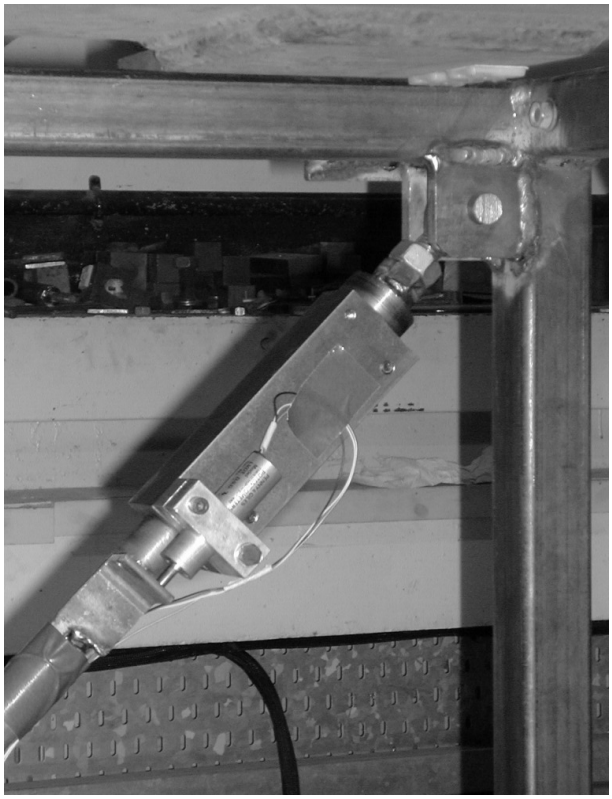


Figure D.7 Detail of a FD instrumented with a small-displacement transducer

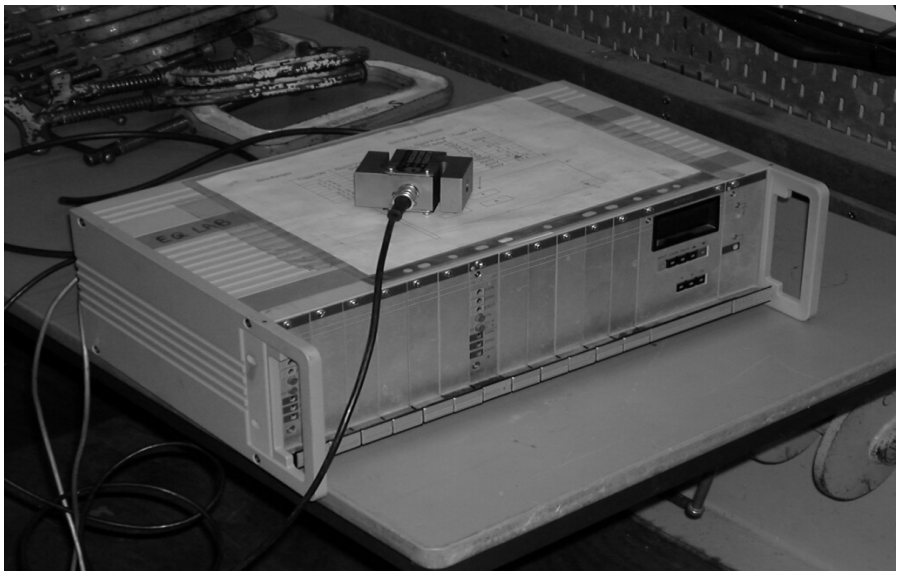


Figure D.8 8-channel amplifier used for the calibration of instruments

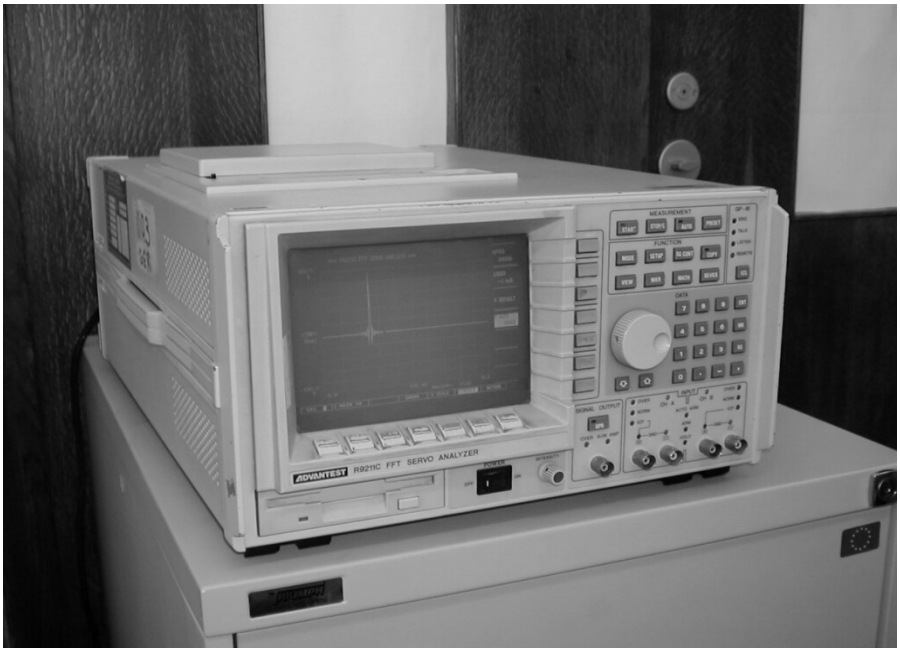
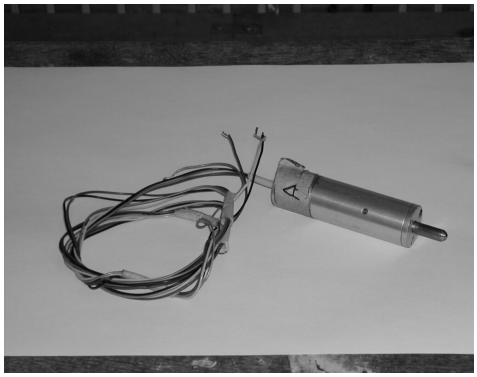


Figure D.9 Spectra analyzer to determine frequencies and damping ratios

Figure D.10 Accelerometer 'Setra'

(a) Displacement transducer 'Celesco' (big displacements)



(b) Displacement transducer 'Penny & Giles' (small displacements)

Figure D.11 Displacement transducers

Figure D.12 Load cell 'Tedea'

D.3.4 Displacement transducers 'Celesco' and 'Penny and Giles'

The 'Celesco' displacement transducer, shown in Fig. D.11a, measures displacements that range from -8 to 8 cm, while the 'Penny and Giles' transducer (see Fig. D.11b) measures smaller displacements: from -2 to 2 cm.

D.3.5 Load cell 'Tedea'

This load cell measures forces that range from -2942 N (-300 kg) to 2942 N (300 kg). This instrument is displayed in Fig. D.12.