PREFACE

This thesis contains the results of the investigations carried out by the author on the integrable and chaotic dynamics of a two coupled Duffing oscillators during the period 1995-1999, under the supervision of Dr. S. Rajasekar, Department of Physics, Manonmaniam Sundaranar University, Tirunelveli-627 012.

The thesis consists of seven Chapters. In Chapter II, integrability of damped and unforced two coupled Duffing oscillators is investigated using Painlevé analysis. For the integrable choices exact analytical solution has been constructed. In Chapter III, the invariance properties of the damped and unforced two coupled Duffing oscillators are studied employing Lie symmetries technique. Integrals of motion are constructed. Chapters IV-VII are concerned with the damped and periodically driven two coupled Duffing oscillators. The occurrence of chaotic behaviour is studied in Chapter IV. Specifically, we consider the system with three physically interesting potentials. We demonstrate the coexistence of periodic attractors, period doubling bifurcations of periodic attractors leading to chaos and merging of attractors. Further, the onset of horseshoe chaos in the perturbed system is investigated by applying the Melnikov-analytical method. In Chapter V, we investigate the migration from one attractor to another with a special emphasis on chaos to periodic by employing various control methods such as adaptive control algorithm, continuous feedback method of Chen and Dong and Singer-Wang-Bau feedback method. Then in Chapter VI, we consider synchronization of subsystems in the two coupled Duffing oscillators. Finally, in Chapter VII, we focus our investigation on the effect of various noises in the system. We study noise-induced intermittent
switching between the coexisting attractors in the two coupled Duffing oscillators. Also, we show the occurrence of crisis-induced and Pomeau-Manneville type-I intermittencies in the noise free system.