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Nota di contenuto	Plates and Shells for Smart Structures; Contents; About the Authors; Preface; 1 Introduction; 1.1 Direct and inverse piezoelectric effects; 1.2 Some known applications of smart structures; References; 2 Basics of piezoelectricity and related principles; 2.1 Piezoelectric materials; 2.2 Constitutive equations for piezoelectric problems; 2.3 Geometrical relations for piezoelectric problems; 2.4 Principle of virtual displacements; 2.4.1 PVD for the pure mechanical case; 2.5 Reissner mixed variational theorem; 2.5.1 RMVT(u, F, sn); 2.5.2 RMVT(u, F, Dn); 2.5.3 RMVT(u, F, sn, Dn); References 3 Classical plate/shell theories3.1 Plate/shell theories; 3.1.1 Three-dimensional problems; 3.1.2 Two-dimensional approaches; 3.2 Complicating effects of layered structures; 3.2.1 In-plane anisotropy; 3.2.2 Transverse anisotropy, zigzag effects, and interlaminar continuity; 3.3 Classical theories; 3.3.1 Classical lamination theory; 3.3.2 First-order shear deformation theory; 3.3.3 Vlasov-Reddy theory;

3.4 Classical plate theories extended to smart structures; 3.4.1 CLT plate theory extended to smart structures; 3.4.2 FSDT plate theory extended to smart structures

3.5 Classical shell theories extended to smart structures 3.5.1 CLT and FSDT shell theories extended to smart structures; References; 4 Finite element applications; 4.1 Preliminaries; 4.2 Finite element discretization; 4.3 FSDT finite element plate theory extended to smart structures; References; 5 Numerical evaluation of classical theories and their limitations; 5.1 Static analysis of piezoelectric plates; 5.2 Static analysis of piezoelectric shells; 5.3 Vibration analysis of piezoelectric plates; 5.4 Vibration analysis of piezoelectric shells; References

6 Refined and advanced theories for plates 6.1 Unified formulation: refined models; 6.1.1 ESL theories; 6.1.2 Murakami zigzag function; 6.1.3 LW theories; 6.1.4 Refined models for the electromechanical case; 6.2 Unified formulation: advanced mixed models; 6.2.1 Transverse shear/normal stress modeling; 6.2.2 Advanced mixed models for the electromechanical case; 6.3 PVD( $u$ ,  $F$ ) for the electromechanical plate case; 6.4 RMVT( $u$ ,  $F$ ,  $s_n$ ) for the electromechanical plate case; 6.5 RMVT( $u$ ,  $F$ ,  $D_n$ ) for the electromechanical plate case; 6.6 RMVT( $u$ ,  $F$ ,  $s_n$ ,  $D_n$ ) for the electromechanical plate case

6.7 Assembly procedure for fundamental nuclei 6.8 Acronyms for refined and advanced models; 6.9 Pure mechanical problems as particular cases, PVD( $u$ ) and RMVT( $u$ ,  $s_n$ ); 6.10 Classical plate theories as particular cases of unified formulation; References; 7 Refined and advanced theories for shells; 7.1 Unified formulation: refined models; 7.1.1 ESL theories; 7.1.2 Murakami zigzag function; 7.1.3 LW theories; 7.1.4 Refined models for the electromechanical case; 7.2 Unified formulation: advanced mixed models; 7.2.1 Transverse shear/normal stress modeling

7.2.2 Advanced mixed models for the electromechanical case

## Sommario/riassunto

"Plates and Shells for Smart Structures firstly gives an overview of classical plate and shell theories for piezoelectric elasticity, demonstrating their limitations in static and dynamic analysis with a number of example problems. The authors then go on to explain how these limitations can be overcome with the use of the more advanced models that have been developed in recent years; introducing theories able to consider electromechanical couplings as well as those that provide appropriate interface continuity conditions for both electrical and mechanical variables. They provide both analytical and finite element solutions, thus enabling the reader to compare the strong and weak solutions to problems. Plates and Shells for Smart Structures is accompanied by dedicated software MUL2 that is used to obtain the numerical solutions in the book, allowing the reader to reproduce the examples given in the book as well as to solve other problems of their own"--