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Matt Allen • Randy Mayes • Daniel Rixen
Editors

Dynamics of Coupled Structures, Volume 1

Proceedings of the 32nd IMAC, A Conference and Exposition
on Structural Dynamics, 2014

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Preface

Dynamics of Coupled Structures, Volume 1 represents one of the eight volumes of technical papers presented at the 32nd IMAC, A Conference and Exposition on Structural Dynamics, 2014, organized by the Society for Experimental Mechanics, and held in Orlando, Florida, February 3–6, 2014. The full proceedings also include volumes on Nonlinear Dynamics; Model Validation and Uncertainty Quantification; Dynamics of Civil Structures; Structural Health Monitoring; Special Topics in Structural Dynamics; Topics in Modal Analysis I; and Topics in Modal Analysis II.

Each collection presents early findings from experimental and computational investigations on an important area within structural dynamics. Coupled structures, or substructuring, is one of these areas.

Substructuring is a general paradigm in engineering dynamics where a complicated system is analyzed by considering the dynamic interactions between subcomponents. In numerical simulations, substructuring allows one to reduce the complexity of parts of the system in order to construct a computationally efficient model of the assembled system. A subcomponent model can also be derived experimentally, allowing one to predict the dynamic behavior of an assembly by combining experimentally and/or analytically derived models. This can be advantageous for subcomponents that are expensive or difficult to model analytically. Substructuring can also be used to couple numerical simulation with real-time testing of components. Such approaches are known as hardware-in-the-loop or hybrid testing.

Whether experimental or numerical, all substructuring approaches have a common basis, namely the equilibrium of the substructures under the action of the applied and interface forces and the compatibility of displacements at the interfaces of the subcomponents. Experimental substructuring requires special care in the way the measurements are obtained and processed in order to assure that measurement inaccuracies and noise do not invalidate the results. In numerical approaches, the fundamental quest is the efficient computation of reduced order models describing the substructure's dynamic motion. For hardware-in-the-loop applications difficulties include the fast computation of the numerical components and the proper sensing and actuation of the hardware component. Recent advances in experimental techniques, sensor/actuator technologies, novel numerical methods, and parallel computing have rekindled interest in substructuring in recent years leading to new insights and improved experimental and analytical techniques.

The organizers would like to thank the authors, presenters, session organizers, and session chairs for their participation in this track.

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Contents

1	Experimental-Analytical Dynamic Substructuring of Ampair Testbed: A State-Space Approach	1
	Mladen Gibanica, Anders T. Johansson, Anders Liljehrn, Per Sjövall, and Thomas Abrahamsson	
2	Experimental Dynamic Substructuring of the Ampair Wind Turbine Test Bed	15
	Jacopo Brunetti, Antonio Culla, Walter D'Ambrogio, and Annalisa Fregolent	
3	Are Rotational DoFs Essential in Substructure Decoupling?	27
	Walter D'Ambrogio and Annalisa Fregolent	
4	Validation of Blocked-Force Transfer Path Analysis with Compensation for Test Bench Dynamics	37
	D.D. van den Bosch, M.V. van der Seijs, and D. de Klerk	
5	Prediction of Forced Response on Ancillary Subsystem Components Attached to Reduced Linear Systems	51
	Sergio E. Obando and Peter Avitabile	
6	Towards Dynamic Substructuring Using Measured Impulse Response Functions	73
	M.V. van der Seijs, P.L.C. van der Valk, T. van der Horst, and D.J. Rixen	
7	Hybrid Modeling of Floating Raft System by FRF-Based Substructuring Method with Elastic Coupling ...	83
	Huang Xiuchang, Zhang Zhenguo, Hua Hongxing, and Xu Shiyin	
8	Experimental Based Substructuring Using a Craig-Bampton Transmission Simulator Model	91
	Mathew S. Allen, Daniel C. Kammer, and Randy L. Mayes	
9	Consideration of Interface Damping in Shrouded Mistuned Turbine Blades	105
	F. Schreyer, J. Gross, P. Reuss, M. Junge, and H. Schoenenborn	
10	Coupling Elements for Substructure Modelling of Lightweight Multi-storey Buildings	113
	Ola Flodén, Kent Persson, and Göran Sandberg	
11	Deformation Mode Selection and Orthonormalization for an Efficient Simulation of the Rolling Contact Problem	125
	Karim Sherif and Wolfgang Witteveen	
12	Towards a Parallel Time Integration Method for Nonlinear Systems	135
	Paul L.C. van der Valk and Daniel J. Rixen	
13	Efficient Model Order Reduction for the Nonlinear Dynamics of Jointed Structures by the Use of Trial Vector Derivatives	147
	Wolfgang Witteveen and Florian Pichler	
14	A Substructuring Method for Geometrically Nonlinear Structures	157
	Frits Wenneker and Paolo Tiso	
15	Craig-Bampton Substructuring for Geometrically Nonlinear Subcomponents	167
	Robert J. Kuether and Matthew S. Allen	

16	Parameterized Reduced Order Models Constructed Using Hyper Dual Numbers	179
	M.R. Brake, J.A. Fike, S.D. Topping, R. Schultz, R.V. Field, N.M. McPeck-Bechtold, and R. Dingreville	
17	Efficient Stochastic Finite Element Modeling Using Parameterized Reduced Order Models	193
	R. Schultz, M.R. Brake, S.D. Topping, N.M. McPeck-Bechtold, J.A. Fike, R.V. Field, and R. Dingreville	
18	Application of a Novel Method to Identify Multi-axis Joint Properties	203
	Scott Noll, Jason Dreyer, and Rajendra Singh	
19	Experimental Identification and Simulation of Rotor Damping	209
	Lothar Gaul and André Schmidt	
20	An Approach to Identification and Simulation of the Nonlinear Dynamics of Anti-Vibration Mounts	219
	A. Carrella, S. Manzato, and L. Gielen	
21	Test Method Development for Nonlinear Damping Extraction of Dovetail Joints	229
	C.W. Schwingshackl, C. Joannin, L. Pesaresi, J.S. Green, and N. Hoffmann	
22	Microslip Joint Damping Prediction Using Thin-Layer Elements	239
	Christian Ehrlich, André Schmidt, and Lothar Gaul	
23	Variability and Repeatability of Jointed Structures with Frictional Interfaces	245
	Matthew R. Brake, Pascal Reuss, Daniel J. Segalman, and Lothar Gaul	
24	Evaluation of North American Vibration Standards for Mass-Timber Floors	253
	Joshua A. Schultz and Benton Johnson	
25	Improving Model Predictions Through Partitioned Analysis: A Combined Experimental and Numerical Analysis	261
	Garrison Stevens, Sez Atamturktur, and Joshua Hegenderfer	
26	Model Reduction and Lumped Models for Jointed Structures	273
	G. Chevallier, H. Festjens, J.-L. Dion, and N. Peyret	
27	A Complex Power Approach to Characterise Joints in Experimental Dynamic Substructuring	281
	E. Barten, M.V. van der Seijs, and D. de Klerk	
28	Prediction of Dynamics of Modified Machine Tool by Experimental Substructuring	297
	Christian Brecher, Stephan Bäumlér, and Matthias Daniels	
29	Static Torsional Stiffness from Dynamic Measurements Using Impedance Modeling Technique	307
	Hasan G. Pasha, Randall J. Allemang, David L. Brown, and Allyn W. Phillips	
30	Full Field Dynamic Strain on Wind Turbine Blade Using Digital Image Correlation Techniques and Limited Sets of Measured Data from Photogrammetric Targets	317
	Jennifer Carr, Christopher Niezrecki, and Peter Avitabile	
31	Comparison of Multiple Mass Property Estimation Techniques on SWiFT Vestas V27 Wind Turbine Nacelles and Hubs	329
	Timothy Marinone, David Cloutier, Kevin Napolitano, and Bruce LeBlanc	
32	Overview of the Dynamic Characterization at the DOE/SNL SWiFT Wind Facility	337
	Bruce LeBlanc, David Cloutier, and Timothy Marinone	
33	Artificial and Natural Excitation Testing of SWiFT Vestas V27 Wind Turbines	343
	Timothy Marinone, David Cloutier, Bruce LeBlanc, Thomas Carne, and Palle Andersen	
34	Effects of Boundary Conditions on the Structural Dynamics of Wind Turbine Blades—Part 1: Flapwise Modes	355
	Javad Baqersad, Christopher Niezrecki, and Peter Avitabile	

35	Effects of Boundary Conditions on the Structural Dynamics of Wind Turbine Blades. Part 2: Edgewise Modes	369
	Javad Baqersad, Christopher Niezrecki, and Peter Avitabile	
36	Modal Testing and Model Validation Issues of SWiFT Turbine Tests	381
	Timothy Marinone, David Cloutier, and Bruce LeBlanc	
37	Development of Simplified Models for Wind Turbine Blades with Application to NREL 5 MW Offshore Research Wind Turbine	389
	Majid Khorsand Vakilzadeh, Anders T. Johansson, Carl-Johan Lindholm, Johan Hedlund, and Thomas J.S. Abrahamsson	
38	A Wiki for Sharing Substructuring Methods, Measurements and Information	403
	Matthew S. Allen, Jill Blecke, and Daniel Roettgen	
39	Novel Parametric Reduced Order Model for Aeroengine Blade Dynamics	413
	Jie Yuan, Giuliano Allegri, Fabrizio Scarpa, and Ramesh Rajasekaran	
40	Practical Seismic FSSI Analysis of Multiply-Supported Secondary Tanks System	427
	Nam-Gyu Kim, Choon-Gyo Seo, and Jong-Jae Lee	
41	DEIM for the Efficient Computation of Contact Interface Stresses	435
	M. Breitfuss, H. Irschik, H.J. Holl and W. Witteveen	
42	Amplitude Dependency on Dynamic Properties of a Rubber Mount	447
	C.B. Nel and J. van Wyngaardt	
43	Model Order Reduction for Geometric Nonlinear Structures with Variable State-Dependent Basis	455
	Johannes B. Rutzmoser and Daniel J. Rixen	
44	Stochastic Iwan-Type Model of a Bolted Joint: Formulation and Identification	463
	X.Q. Wang and Marc P. Mignolet	