บทความที่น่าสนใจประจำเดือนมกราคม 2558

สาขาวิทยาศาสตร์และเทคโนโลยี

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Title:	Mass Matrix Templates: General Description and 1D Examples
Author:	Carlos A. Felippa, Qiong Guo, K. C. Park
Journal:	Archives of Computational Methods in Engineering, January 2015, Volume 22, Issue 1, pp 1-65
Abstract:	This article is a tutorial exposition of the template approach to the construction of customized mass-stiffness pairs for selected applications in structural dynamics. The main focus is on adjusting the mass matrix. Two well known discretization methods, described in FEM textbooks since the late 1960s, lead to diagonally lumped and consistent mass matrices, respectively. Those models are sufficient to cover many engineering applications but for some problems they fall short. The gap can be filled with a more general approach that relies on the use of templates. These are algebraic forms that carry free parameters. Templates have the virtue of producing a set of mass matrices that satisfy certain a priori constraint conditions such as symmetry, nonnegativity, invariance and momentum conservation. In particular, the diagonally lumped and consistent versions can be obtained as instances. Availability of free parameters, however, allows the mass matrix to be customized to special needs, such as high precision vibration frequencies or minimally dispersive wave propagation. An attractive feature of templates for FEM programming is that only one element implementation as module with free parameters is needed, and need not be recoded when the application problem class changes. The paper provides a general overview of the topic, and illustrates it with one-dimensional structural elements: bars and beams.
Database:	SpringerLink

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Title:	BIM-Enabled Structural Design: Impacts and Future Developments in Structural Modelling, Analysis and Optimisation Processes
Author:	Hung-Lin Chi, Xiangyu Wang, Yi Jiao
Journal:	Archives of Computational Methods in Engineering, January 2015, Volume 22, Issue 1, pp 135-151
Abstract:	This review focuses on identifying the impacts and future development trends for current structural design practice in integration of building information modelling (BIM) technologies. BIM technologies, as novel information management schemes they are, are changing the conventional structure design processes. Currently, utilising BIM technologies for reshaping structural design has been widely acknowledged and embraced by both academic and industry circles. In this research, the current status and issues of the structural design processes (including modelling, analysis, and optimisation of structures) are fully investigated with emphases on specific design stages. The research put efforts on surveying the benefits of BIM in facilitating current structural design, such as systematic modelling

	processes, powerful interactive visualization platform, and standardised exchanging data interfaces. Impacts of personnel involvement in structural design when adopting BIM have also been identified in detail. Finally, a predicted cross-functional flowchart of BIM-enabled structural design for the near future is proposed, which shows future developing trends in improving structural design quality and addressing current issues.
Database:	SpringerLink

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Title:	Application of hp-Adaptive Finite Element Method to Two-Scale Computation
Author:	Marta Oleksy, Witold Cecot
Journal:	Archives of Computational Methods in Engineering, January 2015, Volume 22, Issue 1, pp 105-134
Abstract:	Application of a two-scale approach to modeling of inelastic deformations of metal matrix composites is presented in the paper. We use the computational homogenization based on RVE analysis with certain modifications that reduce the computational cost and some approaches to estimate the modeling error introduced by homogenization. Furthermore, the automatic hp -adaptive finite element method is used to deliver approximation error-controlled results in reasonable time. Numerical examples demonstrate the efficiency and accuracy of the developed methods and algorithms.
Database:	SpringerLink

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Title:	A reduced multicomponent diffusion model
Author:	Yuxuan Xin, Wenkai Liang, Wei Liu, Tianfeng Lu, Chung K. Law
Journal:	Combustion and Flame, Volume 162, Issue 1, January 2015, Pages 68–74
Abstract:	The diffusion models for multicomponent mixtures are investigated in planar premixed flames, counterflow diffusion flames, and ignition of droplet flames. Discernable discrepancies were observed in the simulated flames with the mixture-averaged and multicomponent diffusion models, respectively, while the computational cost of the multicomponent model is significantly higher than that of the mixture-averaged model. A systematic strategy is proposed to reduce the cost of the multicomponent diffusion model by accurately accounting for the species whose diffusivity is important to the global responses of the combustion systems, and approximating those of less importance. The important species in the reduced model are identified with sensitivity analysis, and are found to be typically among those in high concentrations with exception of a few radicals, e.g. H and OH, that are known to participate in critical reactions. The reduced model is validated in simulating the propagation of planar premixed flames, extinction of counterflow non-premixed flames and ignition of droplet flames. The reduced model was shown to feature similar accuracy to that of the multicomponent model while the computational cost was reduced by a factor of approximately 5 for an n-heptane mechanism with 88 species.
Database:	ScienceDirect

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Title:	A simplified computational model of the oxidation of Zr/Al multilayers
Author:	Manav Vohra, Timothy P. Weihs, Omar M. Knio
Journal:	Combustion and Flame, Volume 162, Issue 1, January 2015, Pages 249–257
Abstract:	A computational model is developed to describe the oxidation of nanolaminates comprising Zr/Al bilayers. The model is developed in light of recent experimental observations of reactive multilayers ignited in air. These suggest that at early stages following the completion of the formation reaction, the oxidation process is more closely described using a surface-reaction controlled growth regime; however, as the oxide layer thickens, transition to the diffusion controlled growth occurs. A simplified computational model is consequently developed that incorporates both regimes of oxide growth. The evolution of the foil temperature is described using an energy balance equation that takes into account the oxidation heat, oxygen intake and radiative heat loss. The computations are implemented to estimate the oxidation heat release rates and the temperature of the oxidizing foil, and to analyze the impact of radiative heat losses. The temperature measurements are then exploited to characterize the transition from the surface-reaction controlled growth regime to the diffusion-limited growth regime.
Database:	ScienceDirect

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Title:	Study of carbon and carbon–metal particulates in a canola methyl ester air-flame
Author:	Wilson Merchan-Merchan, Henry O. Tenadooah Ware
Journal:	Combustion and Flame, Volume 162, Issue 1, January 2015, Pages 216–225
Abstract:	In this study we show that the interaction of a solid metal in the form of wire in the post flame region formed using a biodiesel or fatty acid methyl ester (FAME) fuel (an oxygenated compound) can contribute significantly to the oxidation of the probe's surface resulting in the deposition of metallic nanoparticles and carbon particulates with complex structural morphologies. The FAME used for forming the flame was canola methyl ester (CME). The interaction of the solid support within a flame medium formed using CME resulted in the formation of a distinct material deposition layer covering the surface of the probe. The formed layer was found to consist of clusters composed of aggregates of primary particles with a nearly spherical shape. The aggregates are composed of primary particles of carbon and of metallic characteristics. Other unique features include carbon networks containing numerous encapsulated ultra-small metal particles (<2.0 nm in diameter), elongated carbon nanofibers, metallic nanorods, and carbon–metal composites. High resolution transmission electron microscopy analysis reveals that the metal nanoparticles have a high degree of crystallinity. It is observed that the time and flame height parameters of the probe–flame interaction are important factors for varying the morphological characteristics of the deposits. Residence times ranging from 40 s to 5 min established a strong correlation to deposit morphology. Energy dispersive X-ray (EDX) analysis of material samples on the formed layers reveals the presence of carbon, iron, nickel,

		chromium and oxygen. The introduction of a probe with similar characteristics in the post flame region formed with No. 2 diesel fuel and air resulted in a thicker material layer covering the surface of the probe. Electron microscopy and EDX analysis showed that the deposits are composed mostly of carbon clusters and no metal content or other complex form of carbon morphology were detected.
	Database:	ScienceDirect

7	Title:	On the search for optimal damage precursors
	Author:	Volker Weiss and Anindya Ghoshal
	Journal:	Structural Health Monitoring, November 2014 vol. 13 no. 6 601-608
	Abstract:	A new approach to predict the service life of critical components via study of damage precursors is emerging and is the topic of this article. To date, most service life predictions are based on measurements of damage indicators and their growth toward criticality or failure, for example, fatigue crack length and material loss due to corrosion or wear. This makes lifetime estimates based on measurements of damage, for example, around half-life, or even at 80% life, difficult and inaccurate. To improve the accuracy and reliability of lifetime prediction, efforts are now underway to determine the state awareness of a critical component during service, based on property characterizations, in addition to the measurements of the direct damage indicators, such as crack length, acoustic emission, ultrasound signals, and eddy current measurements. These characterizations will include indirect damage indicators, that is, precursors and allied or affiliated damage indicators. For affiliated damage indicators, residual stress relaxation or development, phase changes, electrical property (resistivity, dielectric constant, permeability), and microstructural characterization must be considered. The selection of the optimal combination of direct and indirect damage indicators will be application specific. It is proposed to assess the efficacy of damage indicators on the basis of their Di/Df versus Ni/Nf , that is, damage ratio versus life fraction curves (referred to as damage indicator ratio curves), searching for indicators with damage indicator ratio curves that best meet the needs of the application.
	Database:	SAGE Journals Online

8	Title:	A vibro-haptic human–machine interface for structural health monitoring
	Author:	David Mascareñas, Crystal Plont, Christina Brown, Martin Cowell, N Jordan
	Journal:	Structural Health Monitoring, November 2014 vol. 13 no. 6 671-685
	Abstract:	The goal of the structural health monitoring community has been to endow physical systems with a nervous system not unlike those commonly found in living organisms. Typically, the structural health monitoring community has attempted to do this by instrumenting structures with a variety of sensors and then applying various signal processing and classification procedures to the data in order to detect the presence of damage, the location of damage, the severity of damage, and to estimate the

	remaining useful life of the structure. This procedure has had some success, but we are still a long way from achieving the performance of nervous systems found in biology. This is primarily because contemporary classification algorithms do not have the performance required. In many cases, expert judgment is superior to automated classification. This work introduces a new paradigm. We propose interfacing the human nervous system to the distributed sensor network located on the structure and developing new techniques to enable human–machine cooperation. The results from the field of sensory substitution suggest this should be possible. This study investigates a vibro-haptic human–machine interface for structural health monitoring. The investigation was performed using a surrogate three-story structure. The structure features three nonlinearity-inducing bumpers to simulate damage. Accelerometers are placed on each floor to measure the response of the structure to a harmonic base excitation. The accelerometer measurements are preprocessed. The preprocessed data are then encoded as a vibro-tactile stimulus. Human subjects were then subjected to the vibro-tactile stimulus and asked to characterize the damage in the structure.
Database:	SAGE Journals Online

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Title:	A multi-resolution method for 3D multi-material topology optimization
Author:	Jaejong Park, Alok Sutradhar
Journal:	Computer Methods in Applied Mechanics and Engineering, Volume 285, 1 March 2015, Pages 571–586
Abstract:	This paper presents a multi-resolution implementation in 3D for multi-material topology optimization problem. An alternating active-phase algorithm where the problem at hand is divided into a series of the traditional material–void phase topology optimization is employed for the multi-material problem. Different levels of discretization are used for the displacement mesh, design variable mesh and density mesh which provides higher resolution designs for the solutions. A projection scheme is employed to compute the element densities from design variables and control the length scale of the material density. Simple block coordinate descent method similar to the Gauss–Seidel technique is used to solve the subproblems. Several 3D numerical examples are presented to demonstrate the ease and the effectiveness of the proposed implementation. Incorporating the multi-resolution method into the multi-material approach, robust designs with improved resolution can be achieved for real life problems with complex geometries.
Database:	ScienceDirect

10	Title:	Isogeometric mortar methods
	Author:	Ericka Brivadis, Annalisa Buffa, Barbara Wohlmuth, Linus Wunderlich
	Journal:	Computer Methods in Applied Mechanics and Engineering, Volume 284, 1 February 2015, Pages 292–319
	Abstract:	The application of mortar methods in the framework of isogeometric analysis is investigated theoretically as well as numerically. For the Lagrange multiplier two choices of uniformly stable spaces are presented, both of them are spline spaces but of a different degree. In one case, we consider an equal order pairing for which a cross point modification based on a local degree reduction is required. In the other case, the degree of the dual space is reduced by two compared to the primal. This pairing is proven to be inf–sup stable without any necessary cross point modification. Several numerical examples confirm the theoretical results and illustrate additional aspects.
	Database:	ScienceDirect