Dokumenttyp: Zeitschriftenaufsatz

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Titel des Beitrags: An algebraic variational multiscale-multigrid method based on plain aggregation for convection-diffusion problems

Abstract: A new computational framework referred to as algebraic variational multiscale-multigrid method is proposed, representing the initial step of our work on merging the variational multiscale method with algebraic multigrid projection methods. This new approach allows for a separation of resolved scales into various scale groups in a purely algebraic way, that is, with no need to utilize further discretizations beyond the basic one. By this means, it conveniently facilitates the application of modeling terms either to all scale groups or only to selected scale groups, for instance, only to the fine scales of the problem. Variational multigrid techniques form the basis of our new approach. After presenting the cornerstones of the framework for an abstract problem formulation, the close relationship of the variational multiscale method to projection methods in general and to variational multigrid techniques are discussed. The algebraic variational multiscale-multigrid method is then particularly analyzed for convection-diffusion problems. The present initial study focuses on exploiting the methodical aspects of the new framework
by developing a fine-scale discontinuity-capturing approach to diminish oscillations at sharp layers. Our technique including a fine-scale discontinuity-capturing term is applied to numerical examples of strongly convection-dominated convection-diffusion problems. The results demonstrate that it enables the diminuation of local oscillations at parabolic boundary and interior layers by about 60 - 80 percent without any notable smearing effect.

Stichworte:
- variational multiscale method
- algebraic multigrid
- convection-diffusion problem
- fine-scale discontinuity-capturing

Dewey Dezimalklassifikation neu:
- 620 Ingenieurwissenschaften

Zeitschriftentitel:
- Computer Methods in Applied Mechanics and Engineering

Jahr:
- 2009

Band:
- 198

Heft / Issue:
- 47-48

Seiten:
- 3821-3835

Volltext / DOI:
- http://doi.org/10.1016/j.cma.2009.08.017

Status:
- Verlagsversion / published

Semester (für SAP-Datenerfassung):
- SS 09

Format:
- Text

Occurences:
- Einrichtungen > Fakultäten > Fakultät für Maschinenwesen > Institut für Werkstoffe und Verarbeitung > Fachgebiet Mechanik auf Höchstleistungsrechnern (Prof. Gee) > Peer-Reviewed Publications
- Einrichtungen > Fakultäten > Fakultät für Maschinenwesen > Institut für Werkstoffe und Verarbeitung > Lehrstuhl für Numerische Mechanik (Prof. Wall) > Peer-Reviewed Publications > 2009

entries: