

AD2CompEng - Automatic Differentiation and Adjoints Applied to Computational Engineering

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Progress Meeting 6th March 2006

Attendees

Cranfield University : Shaun Forth (SAF), John Pryce.

Southampton University : Andy Keane (AJK), Alex Forrester (AF), .

Oxford University : Mike Giles.

Sheffield University : Ning Qin (NQ), Alan LeMoigne.

ROLLS-ROYCE : Leigh Lapworth, David Radford.

AIRBUS UK : Murray Cross.

BAE SYSTEMS : Iain Barton.

Absent - Emmanuel (Mohamed) Tadjouddine (EMT) - now at Univ. Aberdeen.

Agenda

- 1 Minutes of last meeting.
- 2 Matters arising
- 3 Project Overview (Shaun Forth)
- 4 Differentiation of DGrins2D (Shaun Forth)
- 5 AD & adjoints at Southampton - status, constraints and future (Andy Keane)
- 6 AD & adjoints at Oxford - status, constraints and future (Mike Giles)
- 7 AD & adjoints at Sheffield - status, constraints and future (Ning Qin)
- 8 AD & adjoints at Rolls - status, constraints and future (Leigh Lapworth)
- 9 AD & adjoints at Airbus/BAe - status, constraints and future (Iain Barton/Stefano Tursi)
- 10 Lessons learned from AD2CompEng (led by Shaun Forth)
- 11 Future plans

Minutes of Last Meeting & Matters Arising

From May 2004

- 2: SAF - draft guidelines for application programmers - NOT STARTED.

From June 2005

- 2: SAF/EMT: DGRINS2D - Discrepancies in optima found by AD and FD - coding error (incorrect sign) in use of AD constraint gradient resolves problem. COMPLETE
- 2: SAF/EMT: DGRINS2D - CPU rations for differentiated solver to non-differentiated solver are inconsistent after original solver modified so array arguments passed and not indices to global arrays. Modifying the original code in this way was found to appreciably improve its performance as well as being advantageous to AD.

Minutes of Last Meeting & Matters Arising (ctd)

- 3: SAF: Complex-valued arithmetic used in S'ton MATLAB simulations - extend MAD to handle - NOT STARTED.
- 4: SAF, EMT, NQ: liaise on 2D geometric optimisation problems. Proof of concept optimisations attempted. ONGOING
- 5: SAF, NQ: Investigate suitability of MERLIN adjoint differentiation. NOT ATTEMPTED.

AD2CompEng Project Overview

- **Nov 2001** Proposal [FGQK01] & letters (RR, AUK) submitted.
- **Mar 2002** Grant awarded - earliest start 1st Oct.
- **Mar 2003** After recruitment difficulties Dia Zeidan appointed.
- **Nov 2003** Dia Zeidan resigned.
- **Dec 2003** Emmanuel (formerly Mohamed) Tadjouddine starts on project.
- **Mar 2004** Emmanuel presents IMPNS Newton solver work at ICFD (Oxford) [TFQ04], paper published [TFQ05c].
- **Mar 2004** Shaun co-organises workshop on *AD in Large-Scale Optimisation* at EUCCO 2004 and presents initial differentiation of BEAM3D[FTK04].
- **Jun 2004** First project meeting.
- **Jul 2004** Emmanuel presents BEAM3D work to AD2004 (Chicago) and paper accepted for publication [TFK06].

AD2CompEng Project Overview (ctd)

- **Sep 2004** Emmanuel starts work on Sheffield's time-dependent DGrins3D CFD solver.
- **Apr 2004** Emmanuel presents initial DGrins3D differentiation at 1st EuroAD Workshop.
- **Jun 2005** Second project meeting.
- **Sep 2005** Emmanuel presents DGrins3D differentiation and preliminary optimisation results at ICNAAM [TFQ05b] and full paper submitted to ANACM [TFQ05a].
- **Oct 2006** Shaun completes coding of differentiable mesh generator.
- **Jan 2006** Emmanuel leaves project.
- **Mar 2006** Final project meeting.
- **Jun 2006** Final report due.

References



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Elimination AD applied to Jacobian assembly for an implicit compressible flow solver.

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