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Detailed Status Information

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Current Stage	Decision Sent to Author
Title	Compile time differentiation
Running Title	Compile time differentiation
Manuscript Type	Research Article
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Special Section	N/A
Section	Methods and Algorithms for Scientific Computing
Manuscript Comment	Prof. Uwe Naumann (naumann@stce.rwth-aachen.de) would be an appropriate reviewer of this work
Corresponding Author	Dominic Jones (Netherhall House)
Contributing Author	N/A
Abstract	To ease the burden of manually differentiating arithmetic expressions, typically required for implementing adjoint solvers, a methodology is presented which automatically performs the differentiation of an expression or a block of expressions and yields more efficient machine code than its equivalent source transformation implementation. The methodology leverages template metaprogramming techniques to provide a means of generating the differentiated statements whilst facilitating near perfect inlining of code. Whilst the the functionality of the methodology is limited, it presents what level of run-time performance is achievable.
Associate Editor	Not Assigned
Keywords	Automatic differentiation, Expression Templates, Operator Overloading, Adjoint, Template Metaprogramming, C++
Prior Publication and Simultaneous Submissions	With the exception of those works indicated clearly in both a cover letter and a footnote on the first page of the paper, the authors certify that the general content of the manuscript, in whole or in part, is not submitted, accepted, or published elsewhere, including conference proceedings. Authors should upload any such indicated overlapping works as supporting materials to the submission. The authors also certify that the general content of the manuscript, in whole or in part, will not be submitted, accepted, or published elsewhere, including conference proceedings, while it is under consideration or in production. The only exception is if the authors have received specific prior written approval from the editor-in-chief. These policies do not prohibit releasing the manuscript as a technical report, posting the manuscript to a preprint server, or publishing a short abstract at a conference or workshop that does not formally publish reviewed proceedings. Failure to adhere to this policy is cause for rejection of the manuscript.

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Novelty statement	**What is the novel scientific contribution of this work?** *(If the work builds considerably on one or more previously published papers, please state how the present work extends the previous ones.)*: This work offers a methodology for generating the differential of a mathematical function, programmed in C++, whose execution time is an order of magnitude faster than most existing tools, indeed faster than any known extant tool.
Supplementary materials	**Are you submitting supplementary materials?** *If you answer yes, note that a separate index file listing is required for supplementary materials, briefly describing file contents along with the reason the materials are included.* *Template index files are available for your use here and here. See http://www.siam.org/journals/sisc/supplementary.php for full guidelines on the submission of supplementary materials.* : No
Previous submission information	**Has this manuscript been previously submitted?** If this is a resubmission of a manuscript previously rejected by this or another SIAM journal, please provide details on previous submission of this work, including the journal, manuscript number, and title. Enter "No" in the box below if this manuscript has not been previously submitted to a SIAM journal. Note that a resubmission of a manuscript previously rejected by this or another SIAM journal will be treated as a new submission, with the history of the manuscript made available to the handling editor and, if necessary, also referees. The cover letter should include the criticism in the referee reports and a detailed description of how the manuscript has been revised to meet all the criticism of the original submission. As a new submission, there is no guarantee that it will be handled by the same associate editor or that the original referees will be involved in the evaluation. : no
AMS subject classifications	List AMS subject classifications here in comma-separated format.: Computer science

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