

Zeitschrift: L'Enseignement Mathématique
Herausgeber: Commission Internationale de l'Enseignement Mathématique
Band: 27 (1981)
Heft: 1-2: L'ENSEIGNEMENT MATHÉMATIQUE

Artikel: TOWARDS A COMPLEXITY THEORY OF SYNCHRONOUS PARALLEL COMPUTATION

Autor: Cook, Stephen A.

Kurzfassung

DOI: <https://doi.org/10.5169/seals-51742>

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

Download PDF: 19.08.2025

ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>

TOWARDS A COMPLEXITY THEORY OF SYNCHRONOUS PARALLEL COMPUTATION

by Stephen A. Cook¹⁾

ABSTRACT. This is largely an expository paper on the general theory of synchronous parallel computation. The models of parallel computers discussed include uniform circuit families, alternating Turing machines, conglomerates, vector machines, and parallel random access machines. A classification of these models indicates the need for still more; so “aggregates” and “hardware modification machines” are introduced. The resources sequential time, space, parallel time, circuit size and depth, hardware size etc., are discussed and interrelated. Work in progress at Toronto is mentioned and basic open questions are listed.

1. INTRODUCTION

There is now a well developed computational complexity theory of sequential computation. The precisely “right” computer model is not completely clear, but the main contenders for this model do not differ markedly from each other in their computing efficiency. These contenders are multitape Turing machines, possibly with storage structures more general than linear tapes, and various versions of random access machines. Of these models, the storage modification machine (SMM) made popular by Schönhage [S2] carries the most conviction as a stable and general model of a sequential computer; where we take sequential to mean the number of active elements is bounded in time.

To be sure, there is a feeling that one step of an SMM may be a little too powerful. It is hard to imagine a mechanism for reconnecting a given edge out of a node v_1 in the storage structure to a node v_2 in one step, when the candidates for v_2 from the perspective of the whole computation are unlimited. But the fact remains that if we restrict ourselves to fixed storage

¹⁾ Presented at the *Symposium über Logik und Algorithmik* in honour of Ernst SPECKER, Zürich, February 1980.