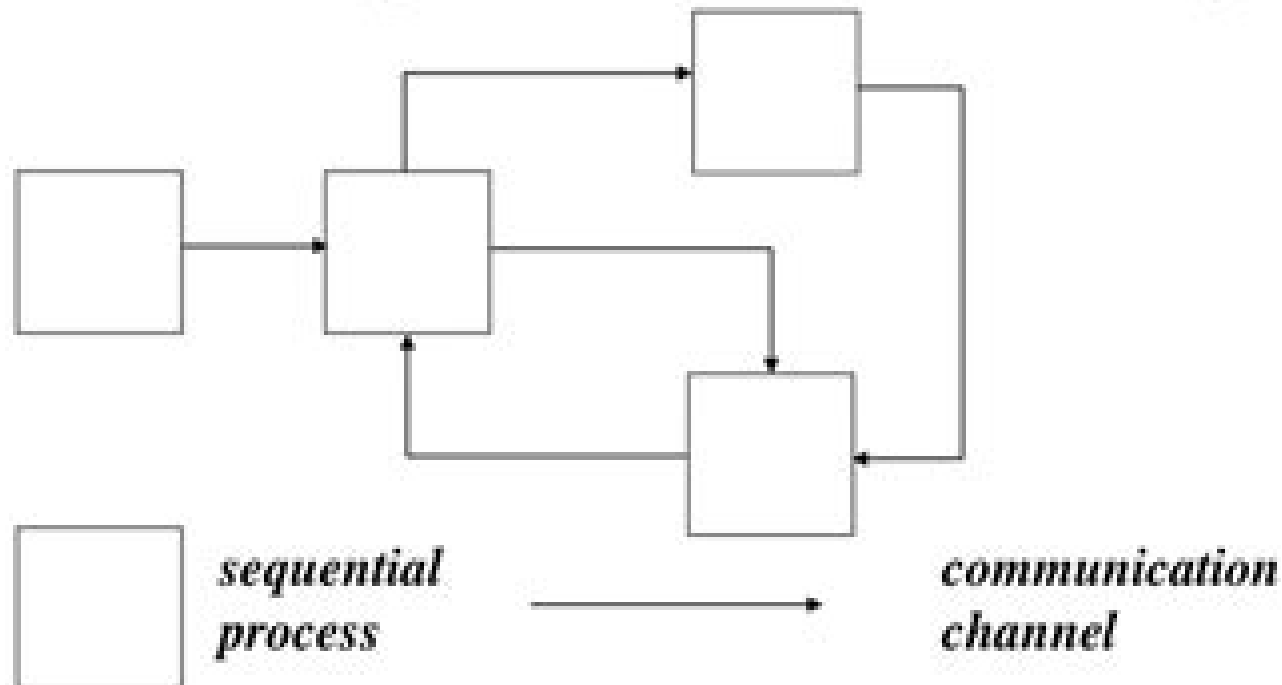


# Communicating Sequential Processes (CSP)



- single thread of control
- autonomous
- encapsulated
- named
- static

- synchronous
- reliable
- unidirectional
- pointtopoint
- fixed topology

# Communicating Sequential Processes

**Stephen D. Brookes**



## **Communicating Sequential Processes:**

**Communicating Sequential Processes** Charles Antony Richard Hoare, 1985      Communicating Sequential Processes  
C.A.R. Hoare, 2021-03-11 Communicating Sequential Processes or CSP is a language for describing patterns of interaction. It is supported by an elegant mathematical theory, a set of proof tools, and an extensive literature. The book *Communicating Sequential Processes* was first published in 1985 by Prentice Hall International, who have kindly released the copyright. It is an excellent introduction to the language and also to the mathematical theory. This is a book for the aspiring programmer, the programmer who aspires to greater understanding and skill in the practice of an intellectually demanding profession. It is designed to appeal first to a natural sense of curiosity which is aroused by a new approach to a familiar topic. The approach is illustrated by a host of examples drawn from a wide range of applications, from vending machines through fairy stories and games to computer operating systems. The treatment is based on a mathematical theory which is described by a systematic collection of algebraic laws. The ultimate objective of the book is to convey an insight which will enable the reader to see both current and future problems in a fresh light in which they can be more efficiently and more reliably solved, and even better, they can sometimes be avoided. The most obvious application of the new ideas is to the specification, design, and implementation of computer systems which continuously act and interact with their environment. The basic idea is that these systems can be readily decomposed into subsystems which operate concurrently and interact with each other as well as with their common environment. The parallel composition of subsystems is as simple as the sequential composition of lines or statements in a conventional programming language. This insight brings practical benefits. Firstly, it avoids many of the traditional problems of parallelism in programming: interference, mutual exclusion, interrupts, multithreading, semaphores, etc. Secondly, it includes as special cases many of the advanced structuring ideas which have been explored in recent research into programming languages and programming methodology: the monitor, class, module, package, critical region, envelope, form, and even the humble subroutine. Finally, it provides a secure mathematical foundation for avoidance of errors such as divergence, deadlock, and non-termination, and for achievement of provable correctness in the design and implementation of computer systems. The material of this book has been tested by presentation in informal workshops as well as on formal academic courses. It was first designed for a one-semester Master's course in software engineering, though most of it could be presented in the final or even the second year of a Bachelor's degree in computing science. The main prerequisite is some acquaintance with high school algebra, the concepts of set theory, and the notations of the predicate calculus. These are summarised on the first page of the glossary of symbols, just after this preface. The book is also a suitable basis for an intensive one-week course for experienced programmers. In such a course, the lecturer would concentrate on examples and definitions, leaving the more mathematical material for later private study. If even less time is available, a course which ends after Chapter 2 is quite worthwhile, and even in a single hour's seminar, it is possible by careful selection to get as far as the

edifying tale of the five dining philosophers      **Communicating Sequential Processes. The First 25 Years** Ali E. Abdallah, Cliff B. Jones, Jeff W. Sanders, 2005-05-04 This volume like the symposium CSP25 which gave rise to it commemorates the semi jubilee of Communicating Sequential Processes 1 Tony Hoare's paper Communicating Sequential Processes is today widely regarded as one of the most influential papers in computer science To commemorate it an event was organized under the auspices of BCS FACS the British Computer Society's Formal Aspects of Computing Science specialist group CSP25 was one of a series of such events organized to highlight the use of formal methods emphasize their relevance to modern computing and promote their wider application BCS FACS is proud that Tony Hoare presented his original ideas on CSP at one of its first meetings in 1978 The two day event 7-8 July 2004 was hosted by London South Bank University's Institute for Computing Research Faculty of Business Computing and Information Management The intention was to celebrate reflect upon and look beyond the first quarter century of CSP's contribution to computer science The meeting examined the impact of CSP on many areas stretching from semantics mathematical models for understanding concurrency and communications and logic for reasoning about behavior through the design of parallel programming languages i o parallelism synchronization and threads to applications ranging from distributed software and parallel computing to information security Web services and concurrent hardware circuits It included a panel discussion with panelists Brookes Hoare de Roever and Roscoe chaired by Je Sanders poster presentations by PhD students and others featured a real alarm requiring evacuation in the rain and concluded with the presentation of a fountain pen to Prof Sir C A R Hoare      Communicating Sequential Processes Charles Antony Richard Hoare, 1986      **A Retrospective on Communicating Sequential Processes** Todd A. Gross, NEVADA UNIV LAS VEGAS DEPT OF COMPUTER SCIENCE AND ELECTRICAL ENGINEERING., University of Nevada, Las Vegas. Department of Computer Science and Electrical Engineering, United States. Army Research Office, 1988 In 1978 C A R Hoare published a draft of a programming language called Communicating Sequential Processes CSP Ten years later we can see that this paper had a profound impact on our perception of parallel computation This paper examines the evolution of CSP over the last 10 years in order to understand its effect on our current perceptions of parallel and distributed computation Keywords include Distributed processing Computers Software Communicating Sequential Processes CSP and Multiprocess programs      **A Multiprocessor Implementation of CSP (Communicating Sequential Processes).** Hwa-Chung Feng, UTAH UNIV SALT LAKE CITY DEPT OF COMPUTER SCIENCE., 1988 Communicating Sequential Processes CSP is a well known paradigm for communication and synchronization of a parallel computation A CSP program consists of a collection of processes  $P_1 P_2 \dots P_N$  that interact by exchanging message These message passing primitives called input and output commands are synchronous a process attempting to output input a message to from another process must wait until the second process has executed the corresponding input output primitive Most of the algorithms mentioned in the last section assume a message based computer architecture no shared memory is assumed This is natural because CSP does not

assume shared memory between constituent processes One might ask why implementation of CSP on a shared memory machine is an issue Psychology Steep deprivation Cognition JES      *System specification with communicating sequential processes (CSP)* Sanjive Agarwala, M. M. Tanik, 1989      **Communicating Sequential Processes. The First 25 Years** Ali E. Abdallah, 2005-05-03 This book commemorates the work done by Tony Hoare and published under the title *Communicating Sequential Processes* in the 1978 August issue of the *Communications of ACM* The British Computer Society's specialist group Formal Aspects of Computing Science organized a meeting on July 7-8 2004 in London to mark the occasion of 25 years of CSP The 19 carefully reviewed and revised full papers by leading researchers celebrate reflect upon and look beyond the first quarter century of CSP's contributions to computer science The papers explore the impact of CSP on many areas ranging from semantics and logic through the design of parallel programming languages to applications varying from distributed software and parallel computing to information security Web services and concurrent hardware circuits

*Introduction to Communicating Sequential Processes* Luming Lai, 1990      *Concurrent Message Passing in Communicating Sequential Processes* Mohan L. Ahuja, Amitabh B. Sinha, 1989      A Theory of Communicating Sequential Processes Stephen D. Brookes, Charles Anthony Richard Hoare, A. W. Roscoe, 1983      Towards Proving Real-time Communicating Sequential Processes Correct K. T. Narayana, 1987      Transforming Communicating Sequential Processes Into Terminating Sequential Processes S. A. Williams, University of Reading. Department of Computer Science, 1983      *A Model for Communicating Sequential Processes* Stephen D. Brookes, 1983      **Semantics of Communicating Sequential Processes** Neelam Soundararajan, 1981      **A Guide to Communicating Sequential Processes** Shan Sun Kuo, Michael H. Linck, Sohrab Saadat, 1978      *Understanding Concurrent Systems* A.W. Roscoe, 2010-10-10 CSP notation has been used extensively for teaching and applying concurrency theory ever since the publication of the text *Communicating Sequential Processes* by C. A. R. Hoare in 1985 Both a programming language and a specification language the theory of CSP helps users to understand concurrent systems and to decide whether a program meets its specification As a member of the family of process algebras the concepts of communication and interaction are presented in an algebraic style An invaluable reference on the state of the art in CSP *Understanding Concurrent Systems* also serves as a comprehensive introduction to the field in addition to providing material for a number of more advanced courses A first point of reference for anyone wanting to use CSP or learn about its theory the book also introduces other views of concurrency using CSP to model and explain these The text is fully integrated with CSP based tools such as FDR and describes how to create new tools based on FDR Most of the book relies on no theoretical background other than a basic knowledge of sets and sequences Sophisticated mathematical arguments are avoided whenever possible Topics and features presents a comprehensive introduction to CSP discusses the latest advances in CSP covering topics of operational semantics denotational models finite observation models and infinite behaviour models and algebraic semantics explores the practical application of CSP including timed modelling discrete

modelling parameterised verifications and the state explosion problem and advanced topics in the use of FDR examines the ability of CSP to describe and enable reasoning about parallel systems modelled in other paradigms covers a broad variety of concurrent systems including combinatorial timed priority based mobile shared variable statecharts buffered and asynchronous systems contains exercises and case studies to support the text supplies further tools and information at the associated website <http://www.comlab.ox.ac.uk/ucs> From undergraduate students of computer science in need of an introduction to the area to researchers and practitioners desiring a more in depth understanding of theory and practice of concurrent systems this broad ranging text reference is essential reading for anyone interested in Hoare's CSP

**Proof Rules for Communicating Sequential Processes** Gary Marc Levin, 1980      **A formal definition of the interaction structure of communicating sequential processes** Sonny Maung, M. M. Tanik, Karl Dürre, 1988      **Partial Correctness of Communicating Sequential Processes** Zhou Chao Chen, C. A. R. Hoare, 1981

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