

FEAST/1

Feedback, Evolution and Software Technology

Case for Support Part 1: Previous Research and Track Record

Lehman's software process research dates back to 1969. It has focused on various topics within an overall theme of increased understanding and improvement. Topics addressed include:

Program evolution and evolution dynamics: As part of a process study at IBM in 1968 he investigated the growth of OS/360. The study suggested that the evolution process necessary to maintain a software system satisfactory develops feedback-system-like behaviour [leh69], its own systems dynamics [bel72]. These constrain system growth despite managerial efforts at control of growth rates and technical direction. His final report, The Programming Process [leh69] led to an invitation to join the prestigious IFIP WG 2.3 on Programming Methodology.

Investigation of non-IBM systems: In follow up work at Imperial from 1972 supported by US ERO, and later by SRC, Lehman extended the OS/360 results and found similar behaviour in other systems [leh80]. This suggested that process dynamics is an inherent property of large software systems and not, as was then suggested, an IBM phenomenon. All this early work was, however, largely limited to one person exploring the immediately available evidence obtained from limited data.

Laws of Program Evolution: The above results provided the basis for stating Laws of Program Evolution. These reflect some consequences of the observed phenomena [leh74,80b].

Program classification: The work also led to a software classification scheme [leh80] whose significance in software process design and improvement is now widely recognised.

Process modelling: Throughout the above investigations, generic process models of E-type system development were investigated and further significant conclusions derived [leh84,85,87,94].

Uncertainty Principle: More recently [leh89,91] he proposed a Principle of Uncertainty based on the observation that embedded assumptions tend to become invalid as the operational domain changes.

FEAST: A proposed comprehensive study of feedback phenomena in the software process and their practical exploitation.

Rustem has worked on the development of algorithms for control and optimisation of a variety of processes [bec94, rus94,]. He has applied the methods of feedback control to modelling the dynamics of economic systems and decision making. The algorithms have been used by HM Treasury, in connection with the Treasury model [bec93] and to provide written memoranda of evidence to the House of Commons Select Committee on the Treasury and Civil Service [wes81].

His work on simple parametrised feedback has been applied to dynamic economic systems to derive optimal decision rules [kar85]. The constraining effect of feedback is studied extensively in[rus90] and [kar85].

As Editor of the Journal of Economic Dynamics and Control he is responsible for publishing papers on the use of control methods in economic decision processes and dynamical systems. As Chairman of IFAC Technical Committee on Computation in Economics, Finance and Engineering - Economic Systems, he is responsible for international collaboration between academics and industry on computational problems in control and decision sciences.

Stenning also has a long-standing interest in the software development process [leh84b], though his work has been industrial rather than academic. Specifically:

With Prof. John Buxton he was responsible for the study that led to the DoD Stoneman report.

At Systems Designers he was responsible for research projects that explored improvement of various aspects of the process, including development methods [leh84b], programming languages and tools.

As Technical Director of IST Ltd he was responsible for high level design and overall development of ISTAR, one of the first project support environments with an explicit process focus [leh85b].

At Anshar he has continued pragmatic research into the systems development process and its role in supporting broader business goals and consulted on process improvement to several major clients.

Lehman and Stenning have previously collaborated in several IST projects. In 1984 they jointly organised the first International Software Process Workshop, now established as the major forum for discussion of software process R&D.

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