4N7. Fourth International Conference on Adaptive Structures. Proceedings from the conference held in Cologne, Germany, Nov 2-4, 1993. - Edited by E Breitbach *(DLR Inst of Struct Mech, Germany)*, BK Wada *(JPL)*, M Natori *(Inst of Space and Astronaut Sci, Japan)*. Technomic, Lancaster PA. 1994. 686 pp. ISBN 1-56676-161-1. $145.00.

This latest conference resulted in the presentation of more than 40 original reports on new materials, design, performance, and applications of advanced structures, components, and controls. The conference was sponsored by leading technical societies including the Deutsche Gesellschaft fur Luft- und Raumfahrt, the American Society of Mechanical Engineers, the American Society of Civil Engineers, the Japan Society of Civil Engineers, and the International Society for Optical Engineering.

The following is a small sampling of contents: Self-sensing multilayer piezoelectric actuator for structural damping application; Controls-structures interaction research at NASA Langley; Analytical studies on the damped dynamic behavior of intelligent laminated composite plates; Performance and characteristics of actuator material; Neural network-based controllers for smart structures; Optimum positioning of actuators for structural control; Multifunctional interface - Implementation strategies; Neural networks for determining weight matrices in optimal structural control; Structural control using multiple active dynamic vibration absorbers; Active distributed vibration control of laminated composite beams and plates; Anisotropic actuation with piezoelectric fiber composites; Damage detection of aircraft structures using dynamic analysis and testing methods; Vibration control of a cylindrical shell using piezoelectric actuator; and Design of shape-memory alloy vibration isolators.

4N8. Proceedings of the AIAA-ASME Adaptive Structures Forum. - AIAA. 1994. ISBN 1-56347-102-7. $160.00.

The 65 technical papers from this forum, held in Hilton Head, S Carolina, April 21-22, 1994, provide new findings in the emerging field of adaptive structures, which include applications to space, atmospheric, and terrestrial systems. There were also sessions on actuators for adaptive structures, piezoelectric actuators and sensors, system identification and damage detection, adaptive control of structures, modeling of adaptive structures, and adaptive shape control.

4N9. Wave Propagation and Emerging Technologies. Proceedings from 1994 Int Mech Eng Congress and Exposition, Chicago IL, Nov 6-11, 1994. - Edited by VK Kinra, RJ Clifton, GC Johnson. ASME, New York. 1994. 224 pp. ISBN 0-7918-1434-3. ASME Book No G00929. $96.00. (ASME members $48.00).

This volume dispels the misconceptions of wave propagation and demonstrates its use in practical engineering.

Applied Nonlinear Dynamics: Analytical, Computational, and Experimental Methods. - AH Nayfeh *(VPI)* and B Balachandran *(Univ of Maryland)*. Wiley, New York. 1995. 685 pp. ISBN 0-471-59348-6. $64.95. (Under review)

Physics and Psychophysics of Music: An Introduction, Third Edition. - JG Roederer *(Geophys Inst, Univ of Alaska, Fairbanks AK 99775-7320)*. Springer, New York. 1995. 219 pp. ISBN 0-387-94298-X. (Under review)

Variational Methods and Complementary Formulations in Dynamics. - B Tabarrok *(Dept of Mech Eng, Univ of Victoria, Victoria, Canada)* and FPJ Rimrott *(Dept of Mech Eng, Univ of Toronto, Toronto, Canada)*. Kluwer, Norwell MA. 1994. 366 pp. ISBN 0-7923-2923-6. $156.00. (Under review)

III. AUTOMATIC CONTROL

4R10. Parallel Processing for Jet Engine Control. Advances in Industrial Control. - HA Thompson *(Marconi Radar and Control Syst, Writtle Rd, Chelmsford CM1 3BN, UK)*. Springer, New York. 1992. 268 pp. ISBN 0-387-19747-8.

Reviewed by A Spang (GE R&D Center, Box 8 KWD 220, Schenectady NY 12301).

This book is an expanded technical report of the author's investigation into the use of parallel processors for aircraft turbofan engines controls for Rolls Royce. As such, the book does not go into detail about either engine control nor parallel processing, but rather it is an engineering assessment of the use of parallel processors to provide increased computational capability for control and engine diagnostics. The investigation concentrates on the T414 and T800 transputer hardware, except for a brief discussion on the BBN Butterfly computer.

Chapter 2 summarizes engine hardware and control strategies for a typical Rolls Royce military engine. The intent is to demonstrate how the required engine control effects the computational load and hence the requirements for parallel computing. In this it is only partially successful since no real details on the control strategy and what determines the timing constraints are provided.

Chapter 3 is the most significant part of the book. It shows how the control strategy outlined in Chapter 2 can be implemented on the transputer hardware. It provides a very good prospective on the problems of implementing parallel control strategies. An ad-hoc decomposition into two, three, and four parallel processors is shown. The limitations caused by interprocessor communications is well demonstrated.

Chapter 4 compares the operation of the transputer to the BBN Butterfly architecture. The results are limited by the state-of-the-art automatic scheduling algorithms which were used. One can question why automatic scheduling was attempted for this dedicated real-time processing application. Single processor systems are generally tightly pre-scheduled to meet tight time response requirements. Therefore, it is not surprising that the same approach is needed for parallel systems.

Chapter 5 attempts, unsuccessfully, to show how formal specification approaches and Rolls Royce design rules would have to be modified to handle parallel processing.

Chapter 6 provides a good summary of fault tolerant architectures and their application to engine control. Three possible approaches are discussed: a backward error recovery system, an overlapping triad system, and a hot sparing system. The triad system appears to be the most suitable, but this is heavily dependent on the transputer architecture.

The final chapter provides an excellent summary of the important points in the book.

Parallel Processing for Jet Engine Control provides a useful discussion of an extensive investigation of parallel computers for engine control. It should be of interest to engineers using parallel computer architectures for real-time control. The strength of this book is in chapter 3, which details the decomposition of tasks to parallel processors, and chapter 6, which discusses fault tolerant architectures. All chapters end with good summaries of the important points discussed in that chapter.

A problem with the book is the inconsistent level of detail provided. Too much detail is provided on the processing and communications hardware and not enough on the control application and how it defines the computational requirements. Thus, the reader wanting to apply the results to his own application will have difficulty since he will not be able to determine how his application differs from the engine control discussed in the book.

4R11. Solving Problems in Control. - RJ Richards *(Univ of Cambridge, UK)*. Wiley, New York. 1993. 232 pp. ISBN 0-470-22076-7. $40.00.

Reviewed by ML Nagurka (Carnegie Mellon Res Inst, 700 Technology Dr, Pittsburgh PA 15219).

In this 232-page paperback, Richards has provided an addition to the *Solving Problems* series in the area of classical feedback control. The textbook is self-contained with a rich source of worked examples. Homework problems with answers follow each chapter. The approach is progressive, starting with the mathematical methods used most frequently in the study of single-input single-output (SISO) systems. Following the development of deterministic models of simple physical systems, an introduction to controls through the use of time domain and frequency response methods is presented.

The book consists of ten chapters. The first three chapters address linear system modeling (for electrical, mechanical, electromechanical, hydraulic, and process systems) and system representations (signal flow graphs and block diagrams). There is no presentation of unifying modeling approaches, such as linear graph or bond graph methods. The fourth chapter introduces systems with proportional feedback control and shows examples of damping as negative feedback (including the effect of adding feedback to brake loaded inertia, and the deliberate addition of damping to

improve behavior), the effect of controller gain on system response, and the use of velocity feedback. The fifth chapter describes system poles and zeros, and basic concepts of stability. Frequency, response ideas, such as polar and logarithmic plots (*ie*, Nyquist diagrams and Bode plots), are introduced in the sixth chapter. Additional controller terms, such as integral and derivative action for PID control, velocity of feedback, feedforward, and cascade control, are discussed in the seventh chapter. Stability in the time domain and stability in the frequency domain are the topics of the eighth and ninth chapters, respectively. Finally, phase lead and lag compensators and loop interaction ideas are developed in the closing chapter.

The author acknowledges that the text cannot be exhaustive either in terms of material presented or in its range of examples. Given its fundamental coverage, the book would be appropriate for students of various engineering disciplines. It may also be used as a stand-alone textbook for an introductory course in controls, or as a companion book for students seeking alternate explanations and a wide set of solved problems.

The book balances well-written explanations of concepts with fully developed solutions of example problems. No reference to software for analysis and design of classical control systems is made. Given the ubiquitous nature of software environments (such as MATLAB), this is a surprising disappointment. The book also does not mention modern control nor advanced topics in controls. Despite these drawbacks, Richards deserves credit for his contribution in a highly competitive market of undergraduate controls textbooks (including RC Dorf, *Modern Control Systems*, Addison-Wesley, 1994; GF Franklin, JD Powell, and A Emami-Naeini, *Feedback Control of Dynamic Systems*, Addison-Wesley, 1994; BC Kuo, *Automatic Control Systems*, 1991; and K Ogata, *Modern Control Engineering*, 1990).

In roughly one-third the pages of the competition, *Solving Problems in Control* succeeds as a highly readable book loaded with a multitude of solved example problems. It promises wide appeal to those seeking an undergraduate-level, no-frills introduction to system dynamics and controls, and is highly recommended.

IV. MECHANICS OF SOLIDS

4R12. Dream Machines: An Illustrated History of the Spaceship in Art, Science and Literature. - R Miller *(Fredericksburg VA)*. Krieger, Melbourne FL. 1993. 714 pp. ISBN 0-89464-039-9. $112.50.

Reviewed by H Benaroya (Dept of Mech and Aerospace Eng, Rutgers Univ, PO Box 909, Piscataway NJ 08855-0909).

Beginning with 360 BC, we are introduced to the wonderful history of the spaceship, from the fantasies and the science fictions to the present efforts to keep humanity's attention on the stars. In a little more than 700 large, profusely-illustrated pages, Miller provides all of us with a marvelous journey through time and space with pictures, poems, and quotes from the minds of those who dared to dream, sometimes 100 years ahead of the fact as did Jules Verne, and sometimes 300 years ahead, as did Johannes Kepler in his novel *Somnium* (The Dream).

It is quite an interesting reading (and picture) experience to spend almost 500 pages contemplating our ancestors' dreams and fantasies of going into space, and then rather suddenly, in the final third of the book, realizing how it started to become a reality with the dawn of the age of flight, and finally *took off* with the technological advancements of the second World War.

Here are a few examples of the information we learn. In 1698, Christian Huygens publishes *Cosmothereos* (The Celestial Worlds Discover'd) where he speculates on the habitability of other worlds and comes to a conclusion that the Moon harbors no indigenous life, or air, or water. "He does admit, however, that extraterrestrial lifeforms might have different constitutions than those here on earth, and admits that 'those great and noble Bodies have somewhat or other growing and living upon them, tho very different from what we see and enjoy here.'"

We learn of KE Tsiolkovsky's systematic study, beginning in 1898, of the theory of rocket dynamics; with results published in 1903.

We read descriptions of Davis Russen's (1703) novel, *Iter Lunaire* (A Voyage to the Moon), where a steel spring is attached to the top of a mountain, with a seat at the other end where a man could sit to be propelled to the Moon. Of course, proper safeguards are in place, and there is a system of pulleys and cables to assure for a safe return to Earth.

...and about Robert Goddard, the Earl of Birkenhead, *Buck Rogers*, Fred Hoyle, Betty Skelton, and among many, many others, Yvonne de Carlo, the actress, who stated in 1952 that "she will want to marry the first man to fly to the Moon 'because he could take me some place I've never been before.'"

A couple of brief comments on the book production. The pages of this $112.50 book appear of good quality, but as this reviewer only received an advance review copy with a throwaway soft cover, it is not possible to comment on the final production quality. Also, the very nature of the book makes its fun to jump throughout the volume rather than follow it chronologically. In this approach, the reader will enjoy reading a paragraph here, a photo or sketch there. However, not all graphics have captions, and it becomes awkward and a bit annoying to link an interesting picture with the paragraph that describes it. All graphics should be captioned in detail. (But, if you love space and rockets, you won't care about my comments above. You must have the book!) There are numerous figures, drawings, sketches, paintings, and renderings, some in color, all of which will amuse, entertain, and fascinate.

While the book is wonderful to read, 25 years after Neil Armstrong's first steps on the Moon, it is a mixed pleasure. Knowing what has already been achieved in space this century, and in particular in the American projects Mercury, Gemini, and Apollo, leaves this reader with regrets that the torch was thrown to the ground with the last Apollo rather than passed on to the next generation of astronauts, explorers, and settlers of the Moon and Mars.

As Miller notes in his Epilogue, a whole generation has grown up without direct experience or memory of the lunar activities of the sixties and seventies. As he states, "this book will be the definitive history of manned spacecraft for the foreseeable future, or it will prove to be only the briefest prologue. We are teetering on a very narrow fence. It is a very high fence and the fall to either side may well be permanent. If we choose the wrong side, it could be a great many years before the fence is again scaled." He goes on to say that if we choose the right side of the fence, we may see rockets and space ships such as the National Aerospace Plane, the *Freedom*, the *Hermes*, taking us to space, the Moon, and beyond.

I, too, am optimistic on the future of space exploration and our eventual colonization of the Moon and Mars. All we need is the political will and leadership. The engineers are ready to support this effort. The future citizens of the Moon and Mars have already been born. The unanswered question is whether their native language is English.

This reviewer recommends the purchase of *The Dream Machines: An Illustrated History of the Spaceship in Art, Science, and Literature*. The reader will be drawn to it very often, for hours at a sitting. It is a wonderful testament to human creativity and spirit, and to the adage "what can be imagined, can be created."

4R13. Machine Design Data Handbook. - K Lingaiah. McGraw-Hill, New York. 1994. 896 pp. ISBN 0-07-037933-5. $136.50.

Reviewed by WC Orthwein (PO Box 3332, Carbondale IL 62902).