

Resources

Software: Matlab

Textbook: none.

References: in Library Open Reserve

i T. Kailath (1980). Linear Systems. Prentice Hall. P003/202

ii GC Goodwin, SF Graebe, ME Salgado (2000),
Control System Design. Prentice Hall. P629.8/203

iii K Zhou (1998). Essentials of Robust Control. Prentice Hall. P629.8/205

Teaching Strategies

Lectures

to give the basic material in written form,
and to highlight the importance of different sections,
and help with the formation of schema.

Assignments

to give practice in problem solving, and to assess your progress.

Examination

the final test of competency.

Learning Outcomes

At the end of the course the student will be familiar with basic aspects of multivariable linear system theory and control, from both an input/output and a state space point of view. The student will be able to use this knowledge to solve basic problem in multivariable linear system theory and multivariable control design.

Week	Topic
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| 1a | Matrix Review
Including: eigenvector decomposition; singular value decomposition; matrix inversion lemma; projection lemma; generalised inverses. |
| 1b | Review SISO State Space
Including: transformation between transfer function and state space ; modal transformation; controllability ; observability. |
| 2a | state space decomposition theorem; polynomial division; Sylvester resultant and coprimeness. |
| 2b | Feedback
Linear state feedback; Bass-Gura formula; modal approach; classical one degree of freedom control review; sensitivity function; internal model principle. |
| 3a | Linear state feedback with observer; transfer function view; Bezout equation. |
| 3b | limits to control; right half plane zeroes. |
| 4a | tracking and disturbance rejection; state space approach and transfer function equivalent; Bezout equations; internal model principle. |
| 4b | MIMO systems
introduction; state space modal form; Gilbert's form; transfer function; matrix fraction description; state space; controllability, observability. |
| 5a | Polynomial Matrices
unimodular matrices; Smith form; Smith-McMillan form; Kalman minimal state space representation; McMillan degree. |
| 5b | MIMO poles and zeroes.
State space view; matrix fraction description view; transfer function view (Smith McMillan form); equivalences. |
| 6a | MIMO decomposition theorem; transform to controllability form, crate diagram; controllability indices. |
| 6b | Hankel methods.
Silverman-Ho-Kung-Aoki method for minimal realization from Markov parameters. |
| 7a | Balanced realization. |
| 7b | MIMO Linear state feedback with observer and MFD equivalent. |

Academic Honesty and Plagiarism

What is Plagiarism?

Plagiarism is the presentation of the thoughts or work of another as one's own.* Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via: www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts. Individual assistance is available on request from The Learning Centre. Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient

time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with permission from the University of Newcastle.

† Adapted with permission from the University of Melbourne.