TW244 (20710-244) Toegepaste Differensiaalvergelykings / Applied Differential Equations 2017

Toegepaste Wiskunde
Wiskundige Wetenskappe
Universiteit Stellenbosch

Applied Mathematics
Mathematical Sciences
Stellenbosch University

Inhoud: Wikipedia beskryf toegepaste wiskunde as die oplos van praktiese probleme deur wiskundige modelle te formuleer en te bestudeer. Die proses van probleemoplossing kan in 'n paar stappe opgebreek word: identifisering van 'n probleem, formulering van 'n model, oplossing van die model (analities of met hulp van 'n rekenaar), analise van die oplossing, en (indien nodig) verfyning van die model. In baie gevalle bestaan die resulterende wiskundige model uit een of meer gewone differensiaalvergelykings, en dit is waarop ons gaan fokus. Ons gaan die bogenoemde oplossingsprosedure bestudeer wanneer dit op verskeie tipiese meganiese, chemiese, en bevolkingsgroei probleme (onder andere) toegepas word.

Content: Wikipedia eloquently describes applied mathematics as "[solving] practical problems by formulating and studying mathematical models.". Typically the problem solving process can be broken down in to a few steps; identification of a problem, formulation of a model, solution of the model (either analytically or computer-aided), analysis of the solution, and (if necessary) refinement of the model. In many cases the resulting mathematical model is one or more ordinary differential equations, and it these on which we focus in this course. We will investigate the modelling and solution procedure described above when be applied to several typical problems from mechanics, chemistry, and population growth (among others).

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Tyd en plek:

- Lesings:
  - Maandae 10:00 in A406
  - Dinsdae 8:00 in A406
  - Vrydae 11:00 in A305
- Tuts: Woensdae 14:00 in A406 of NARGA D

Time and place:

- Lectures:
  - Mondays 10:00 in A406
  - Tuesdays 8:00 in A406
  - Fridays 11:00 in A305
- Tuts: Wednesdays 14:00 in A406 or NARGA D

Taalspesifikasie: Hierdie module sal in Engels aangebied word, alhoewel alle materiaal in Afrikaans beskikbaar gestel sal word. Vir meer besonderhede, sien Opsie 3 van die Natuurwetenskappe Fakulteit taalbeleid en paragraaf 7.1.5. in die taalbeleidsdokument van die Universiteit.

Language specification: This module will be presented in English, however all material will be made available also in Afrikaans. For more details see Option 3 of the Science Faculty language policy and paragraph 7.1.5 in the language policy document of the University.

Voorvereistes: Wiskunde 114 en 144. Basiese tegnieke van differensiaal- en integraalrekeninge is noodsaaklik, en 'n mate van rekenaarvaardigheid (MATLAB of Python) word verwag.

Prerequisites: Mathematics 114 and 144. Basic techniques of differential and integral calculus are essential, and some measure of computer skill (MATLAB or Python) is expected.

Handboek:

Textbook:

D.G. Zill & W.S. Wright: *Differential Equations with Boundary-Value Problems*, 8th ed, Brooks/Cole, 2013.

Ons sal geselekteerde materiaal uit hoofstukke 1, 2, 3, 4, 5, 7, 8, & 10 dek.

We will cover selected material from Chapters 1, 2, 3, 4, 5, 7, 8, & 10.

Module webblad: Besoek die webblad gereeld vir belangrike aankondigings, klasnotas, nuwe opdragte, toetsinligting, skedule, ens.

Module website: Visit the website regularly for important announcements, class notes, new assignments, test information, schedule, etc.

http://appliedmaths.sun.ac.za/TW244/

Note: Kommunikasie buite die lesings sal hoofsaaklik gedoen word deur die kursus webwerf se informasie-afdeling (d.w.s. geen SUNLearn). Dit is u verantwoordelikheid om dit gereeld dop te hou.

Note: The information section of the course website will be the primary means of communication outside lectures (i.e., no SUNLearn). It is your responsibility to check this regularly.

Uitkomste: Die module fokus op die modellering van verskeie praktiese probleme met behulp van gewone differensiaalvergelykings. Hierdie probleme sluit in: beweging teen weerstand, meganiese ossillasies, bevolkingsgroei en kompartementele stelsels.

Na afloop van die module sal die student in staat wees om

- Probleme korrek te identifiseer
- Toepaslike aannames te maak
- 'n Gepaste wiskundige model te konstrueer

Verder sal die student

- Die model kan analiseer, hetsy analities of rekenaarmatig,
- Waarna die oplossing in terme van die oorspronklike probleem interpreteer word,
- Bevestig resultate teen eksperimentele data (indien beskikbaar)

Outcomes: The module focuses on the modelling of several practical problems with the aid of ordinary differential equations. These problems include: motion against resistance, mechanical oscillations, population growth, and compartmental systems.

Upon completion of the module the student will be able to

- Identify problems correctly
- Make suitable assumptions
- Construct a suitable mathematical model

Furthermore, the student will be able to

- Solve the model, either analytically or by computer
- Interpreted the solution in terms of the original problem
- Validate results against experimental data (if available)

Tutoriale: Die tutoriaalsessies op Woensdae kan een van twee vorme aanneem:

- 'n Tradisionele pen-en-papier oefensessie van probleemoplossing. Verwag 'n kort tutoriaaltoets by elk van hierdie geleenthede (±30min).
- Daar word in NARGA aan 'n rekenaaropdrag gewerk, waar hulp beskikbaar is. Die opdragte word ingehandig (normaalweg 'n week later). Opdragte kan in MATLAB of Python gedoen word.

Die semesterpunt word saamgestel uit 6 rekenaaropdragte en 6 tutoriaaltoetse, waarvan die beste 5 van elkeen bydra tot die finale punt.

Tutorials: The tutorial sessions on Wednesdays can take one of two forms:

- Traditional pen-and-paper exercises in problem solving. Expect a short tutorial test at each of these (±30mins).
- Work on a computer assignment in NARGA, where help is available. The assignments are handed in (normally a week later). Assignments may be submitted in MATLAB or Python.

The semester mark will be formed of 6 computer assignments and 6 tutorial tests, of which the top 5 of each will be counted.

Evaluering: Hierdie kursus maak gebruik van buigsame assessering met die finale punt as volg:

Semesterpunt (SP)	34%
Termyntoets (A1)	33%
Termyntoets (A2)	33%

d.w.s., FP = 0.34×SP + 0.33×A1 + 0.33×A2.

FP ≥ 50 'n slaag en FM < 50 is 'n faal.

'n Derde geleentheid A3 is beskikbaar vir studente wat A1 of A2 mis weens 'n siekte of wat 40 ≤ FP < 50 na A2 het. In die laasgenoemde geval verlang die A3 punt die laagste van die A1 en A2 punte en die maksimum FP is 50. Daar word geen subminimum vereis om A2 te skryf nie, alhoewel daar 'n 25% subminimum vereis word vir A2 om te slaag.

Ter bevestiging: A1/A2 is verpligtend en jy mag nie kies of jy A1/A2 wil skryf nie. Dit is nie moontlik om jou punt te verbeter deur A3 te skryf as jy reeds geslaag het na A2 nie.

Plagiaat in opdragte sal ernstige gevolge hê. In die besonder behou die dosent die reg voor om iemand wat aan plagiaat skuldig bevind is, te onderwerp 'n rekenaartoets, wat hul SP kan beïvloed.

Assessment: This course uses Flexible Assessment with the final mark (FM) weighted as follows:

Semester Mark (SM)	34%
Term test (A1)	33%
Term test (A2)	33%

i.e., FM = 0.34×SM + 0.33×A1 + 0.33×A2.

FM ≥ 50 is a pass and FM < 50 is a fail.

A third test opportunity A3 is available for students who miss either A1 or A2 through sickness or have 40 ≤ FM < 50 after A2. In the latter case the A3 mark replaces the lower of the A1 and A2 marks and the max FM is 50. There is no subminimum required to write A2, however there is a 25% subminimum required in A2 in order to pass.

To confirm: A1/A2 are compulsory and you may not choose whether you want to write A1/A2. It is not possible to improve your mark by writing A3 if you have already passed after A2.

Plagiarism in assignments will have severe consequences. In particular, the lecturer reserves the right to submit anyone found guilty of plagiarism to a computer test, which will influence their SM.

Toets datums:

- A1: 21 Aug @ 5PM & A2: 28 Oct @ 2PM

Test dates:

- A1: 21 Aug @ 5PM & A2: 28 Oct @ 2PM