TOEGEPASTE WISKUNDE
DEPARTEMENT WISKUNDIGE WETENSKAPPE
UNIVERSITEIT STELLENBOSCH

APPLIED MATHEMATICS
DEPARTMENT OF MATHEMATICAL SCIENCES
STELLENBOSCH UNIVERSITY

Inhoud: Die doel van die module is om 'n aantal rekenaarmetodes te bemeester om wiskundige probleme op te los wat andersins moeilik of selfs onmoontlik is om met analitiese tegnieke (d.w.s. potlood-en-papier) te doen.

Die onderwerpe wat behandel word sluit in: Rekenkunde met eindige noukeurigheid, Afrondingsfoute en stabiliteit, Oplossing van nie-lineêre vergelykings, Interpolasie, Kubiese latfunksies, Numeriese differensiasie, Numeriese integrasie, Numeriese oplossing van beginwaardeprobleme, Eindige-verskil metodes vir randwaardeprobleme en parsiële differensiaalvergelykings. Nie veel aandag word gegee aan oplos van lineêre stelsels nie (dws, numeriese lineêre algebra), aangesien dit breedvoerig behandel word in die honneursmodule TW776.

Content: The aim of this module is to master a number of computer methods for solving mathematical problems that would otherwise be difficult or even impossible to solve analytically (i.e., with pen and paper)

The topics covered include: Finite precision arithmetic, Rounding error and stability, Solving nonlinear equations, Interpolation, Cubic splines, Numerical differentiation, Numerical integration, Numerical solution of initial-value problems, Finite difference methods for boundary-value problems and partial differential equations. Not much attention is given to the solution of linear systems (i.e., numerical linear algebra) as this is covered extensively in the honours module TW776.

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Tyd en plek:
- Lesings:
    - Maandae 09:00 in A404
    - Woensdae 12:00 in A404
    - Donderdae 08:00 in A404
- Tuts: Vrydae 14:00 in A407 <u>of</u> NARGA A

Time and place:
- Lectures:
    - Monday 09:00 in A404
    - Wednesday 12:00 in A404
    - Thursday 08:00 in A404
- Tuts: Friday 14:00 in A407 <u>or</u> NARGA A

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.

Handboek:

Textbook:

Timothy Sauer, Numerical Analysis, 2nd Edition, Pearson, 2012

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/TW324/

Voorvereistes: Daar word aanvaar dat u kennis het van die basiese tegnieke van differensiaal- en integraalrekene, en die meetkundige betekenis van hierdie bewerkings. Basiese bedrewenheid met MATLAB of PYTHON word ook aanvaar. Toegepaste Wiskunde TW244 is nuttig, maar nie nodig nie.

Prerequisites: It is assumed that you possess knowledge of basic techniques from differential and integral arithmetic, and the geometric meaning of these operations. Basic proficiency with MATLAB or PYTHON is also assumed. Applied Mathematics TW244 is useful, but not necessary.

Uitkomste: Na afloop van hierdie kursus moet die student, wanneer gekonfronteer met 'n moeilike wiskundige probleem:

(a) 'n ingeligte besluit kan neem oor watter rekenaarmetode die mees effektiewe is vir die betrokke probleem,

(b) daardie metode effektief op 'n rekenaar kan implementeer met inagneming van die spoed waarmee dit uitvoer sowel as numeriese stabiliteit, en

(c) die resultate sinvol interpreteer en indien nodig die algoritme en/of die implementering verbeter.

Outcomes: After this course a student, when confronted with a difficult mathematical problem, should be able to:

(a) make an informed decision as to which computer method is most effective for the problem,

(b) implement that method efficiently on a computer, taking into account the speed at which it executes as well as numerical stability, and

(c) interpret the results in a meaningful way and, if necessary, improve the algorithm and/or implementation.

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

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

Hou asb die webblad dop om te sien waar ons elke Vrydag ontmoet.

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

- Traditional pen-and-paper exercises in problem solving. Expect a short tutorial test at each of these.
- Work on a computer assignment in NARGA, where help is available. The assignments are handed in (normally a week later).

Please keep an eye on the website to see where we meet every Friday.

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 $\geq$ 50 'n slaag en FM < 50 is 'n faal. Die SP word saamgestel uit 6 rekenaaropdragte en 6 tutoriaaltoetse, waarvan die beste 5 van elkeen bydra tot die finale punt.

'n Derde geleentheid A3 is beskikbaar vir studente wat A1 of A2 mis weens 'n siekte of wat 40 $\leq$ 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 beïnvloed.

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 $\geq$ 50 is a pass and FM < 50 is a fail. The SM will be formed of 6 computer assignments and 6 tutorial tests, of which the top 5 of each will be counted.

A third test opportunity A3 is available for students who miss either A1 or A2 through sickness or have 40 $\leq$ 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.