

TOEGEPASTE WISKUNDE  
DEPARTEMENT WISKUNDIGE WETENSAPPE  
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.

**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)

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 partiële 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.

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 of 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 or NARGA A

**Taalspesifikasie:** Volgens die universiteit se jaarboek (2015, deel 5) moet hierdie module die “E+i” opsie volg, d.w.s. oorwegend Engels. Alle materiaal sal egter ook in Afrikaans beskikbaar wees.

**Language specification:** This module must follow the “E+i” option, which means predominantly English. However all material will be made available also in Afrikaans.

**Handboek:**

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

**Textbook:**

**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://dip.sun.ac.za/courses/TW324/>

**Voorvereistes:** Daar word aanvaar dat u kennis het van die basiese tegnieke van differensiaal- en integraalrekenen, 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.

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**Uitkomst:** 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.

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**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 Vrydae 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.

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**Evaluering:** Hierdie module maak gebruik van buigsame assessering. Jou finale prestasiepunt word soos volg bereken:

Kwartaaltoets 1	33%
Kwartaaltoets 2	33%
Tutoriaaltoetse	17%
Rekenaaropdragte	17%

Noot:

- Alle tutoriaaltoetse en assessering sal tel vir die TT en CA punte.
- Daar sal geen herevalueringsgeleenthede wees nie.
- Daar is 'n subminimum van 25% vereis op kwartaaltoets 2 om hierdie module te slaag.

**Assessment:** This module uses flexible assessment. Your final mark will be calculated as follows:

Term Test 1	33%
Term Test 2	33%
Tutorial Tests	17%
Computer Assignments	17%

Note:

- All tutorial tests and assessments will count towards the TT and CA marks.
- There will be no re-evaluation opportunities.
- There is a subminimum of 25% required on Term Test 2 to pass this module.

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**Belangrike datums:**

- Toets 1: 26 April 5PM
- Toets 2: 16 Mei 9AM

**Important dates:**

- Test 1: 26 April 5PM
- Test 2: 16 May 9AM