Educational VMEC

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Overview

- **VMEC** is a heavily used code to compute the MHD equilibrium of stellarators
  - 1983 (fixed-boundary): 518 citations
  - 1986 (free-boundary): 537 citations
- originally written in Fortran-77 + C preprocessor macros
- include(s/d) many additional tools and extensions
  - 1d & 2d preconditioner, equilibrium reconstruction, RFP, ANIMEC, both text and netCDF outputs, sequence of runs, recover if convergence problems, ... => difficult to understand program flow
- back to the roots: „educational VMEC“

Educational VMEC

- VMEC2000 v8.52 serial (from STELLOPT v2.51 release)
- stripped down to bare minimum for computing MHD equilibrium for stellarator
- removed most of „advanced“ features to keep algorithm simple
  - legacy text output files, sequence of runs, 2d-preconditioner, RFP, ANIMEC, ...
- build system: cmake incl. automatic finding netCDF libs
  - should be trivial to compile and run on standard Linux system
- available on GitHub: educational_VMEC

VMEC nested call structure

- vmec
  - eqsolve
    - evolve
      - funct3d
        - ..... some physics .....
        - ..... more physics .....

- main driver, multi-grid iteration
  - force iterations, time step control
    - conjugate-gradient method
      - eval MHD forces
        - ... and all that is req'd for them ...
        - ... and more

- intermediate runvmec routine (for reverse-communication loop) has been removed

Link to articles

- Time Step Algorithm: 1983 article, section VII.A
- constrained toroidal current: ORMEC article, Sec. 2.3