

The Crayon Code

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Pencil Code User Meeting
New York – July 2010

The motivation for Crayon

- The code has grown too big
 - Students find it hard to start hacking the code
 - Which subroutines are important?
- Some voices out there say the Pencil Code is "a mess"
- A clean stripped down version for educational purposes



Hydro Equations

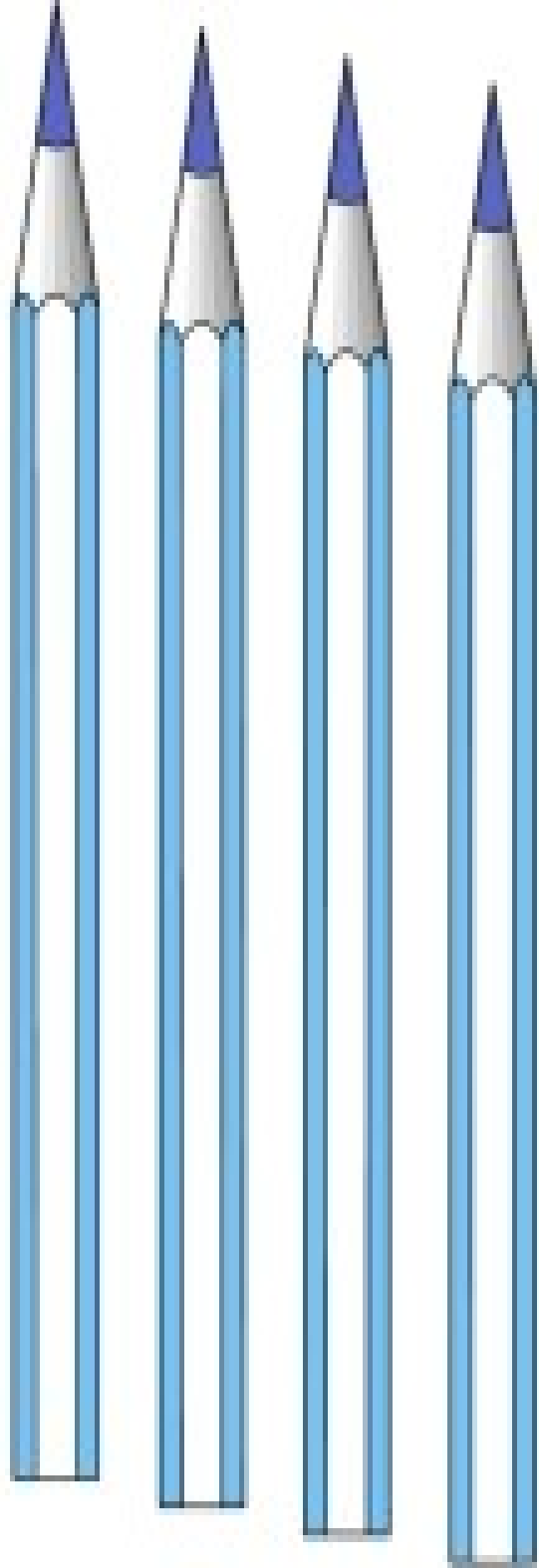
$$\frac{\partial \rho}{\partial t} = -(\mathbf{u} \cdot \nabla) \rho - \rho \nabla \cdot \mathbf{u}$$

$$\frac{\partial s}{\partial t} = -(\mathbf{u} \cdot \nabla) s$$

$$p = \rho c_s^2 / \gamma$$

$$\frac{\partial \mathbf{A}}{\partial t} = \mathbf{u} \times \mathbf{B}$$

$$\frac{\partial \mathbf{u}}{\partial t} = -(\mathbf{u} \cdot \nabla) \mathbf{u} - \nabla \Phi - \rho^{-1} (\nabla p + \mathbf{J} \times \mathbf{B}) + \nu \nabla^2 \mathbf{u}$$



Code grown too big – Example: Continuity Equation

$$\frac{\partial \rho}{\partial t} = - (\mathbf{u} \cdot \nabla) \rho - \rho \nabla \cdot \mathbf{u}$$

```
if (ldensity_nolog) then
    df(11:l2,m,n,irho) = df(11:l2,m,n,irho) - p%ugrho - p%rho*p%divu
else
    df(11:l2,m,n,ilnrho) = df(11:l2,m,n,ilnrho) - p%uglnrho - p%divu
endif
```

However, in the main code, it has grown to 62 lines!

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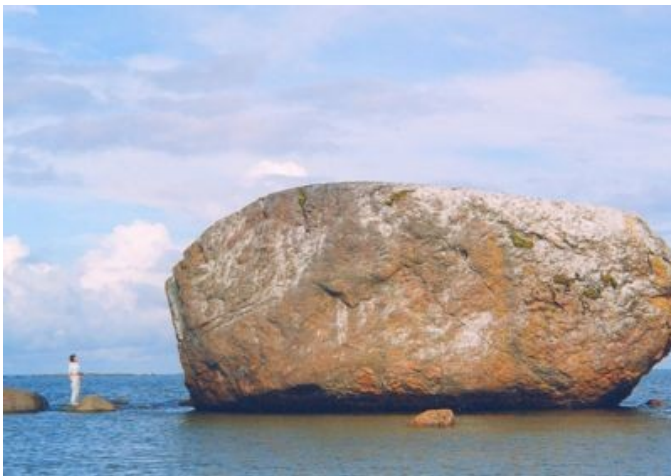
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Major stripping down

	Pencil	Crayon
N of files	192	56
N of subroutines	3701	1140
N of lines	204056	55099



What crayon is

- An educational tool
- A way for users to see the core of the code
- A naked and transparent version of the pencil kernel

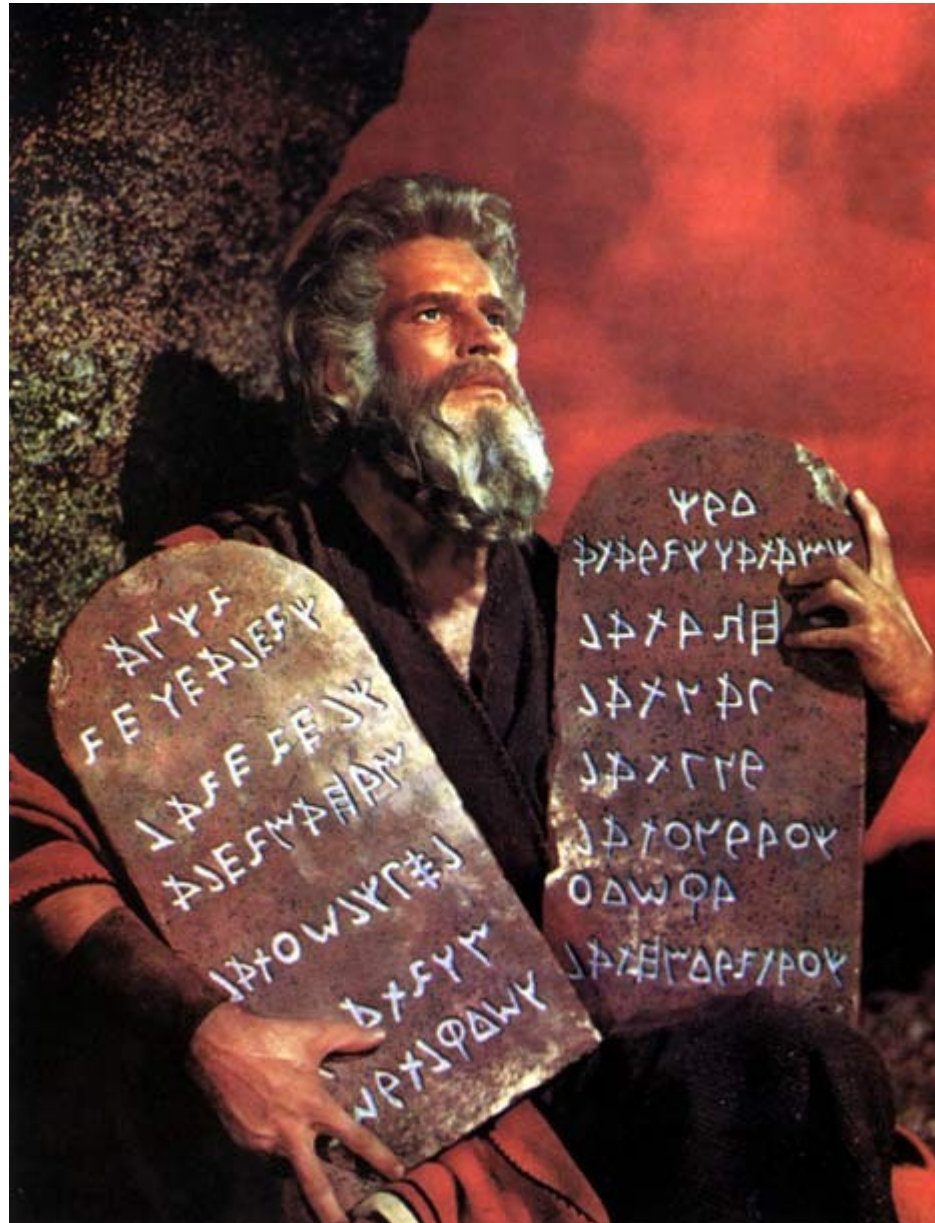
What crayon is **NOT**

- A separate code
- A version of Pencil to be used for production
 - It should not compile more than no-modules and most-modules
- Something that should be used in a paper....

Challenges

- Avoid what happened to Zeus
Thousands of versions of "Zeus-like" codes.
- Avoid it becoming a separate code.
- Port major changes from Pencil to Crayon.

The Code Commandments



The Code Commandments

Pencil's commandments can be synthesized in two

Thou shalt respect the coding standard

Thou shalt not break the auto-test

And the golden rule

If you break the auto-test, fix it!!

The Code Commandments

Thou shalt respect the coding standard

- Respect indentation
- Comment your subroutines
 - No CamelCase variables
- Do not add public variables
 - Global variables are evil

The Code Commandments

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The Code Commandments

My suggestions

- No un-encapsulated code in the main `dXX_dt` subroutines
apart from the canonical equation terms

(this means - mass source terms, momentum removing terms,
mean field terms, should be in subroutines)

- Keep your initial conditions to yourself
(Axel disagrees)