2-D Fully Developed Stationary or Rotating Channel

Steady calculations of x-momentum with the MARVS Reynolds stress model and frame rotation. Input for 3 examples is given here.

1. Conditions corresponding to the DNS of Kristoffersen and Andersson (1993) with Rtau=194 and Ro=0 to 0.5. This is a basic test case to check the Reynolds stress model is correctly implemented. The example is like in Moore and Moore, 2009, except that here the MARVS variation of the MARV model is used.
2. Conditions to set up the inlet profiles for the Kasagi backstep example, Rd=9550.
3. Conditions for Rd=40,000.

1. Unix instructions to run the K&A example

Bring up a terminal window and cd to chan2d.fdf.example, then

```
mkdir out
../../a.m4d < in.marvsRtau194.Roall > out/print
mv out outKA
```

Input/Output

The primary input file - in.marvsRtau194.Roall uses several other input files for specific tasks.

inn.grid.001c.1f1.47 - set up the grid using the using the master geometry, geom.cartesian, the wall boundary condition, and other geometric arrays.

inn.init - initializations, including uniform velocity, Reynolds stress model variables, the laminar viscosity, dpdx, and zrotation if Ro is set.

inn.iter2d.umarvs - take 1 iteration of the 2-d steady flow procedure to solve x-momentum and the Reynolds stress equations. Because the flow is 2d and fully developed there is no convection term in the equations. Because the flow is steady there is no time term. This makes the combination of momentum and the Reynolds stress model "stiffer". To aid convergence of the iterative procedure an eddy viscosity model is used for relaxation. I.e., only for calculating the change in U1 over the iteration, so that the converged solution is unaffected by this addition. inn.iter2d.umarvs adds per-iteration convergence info to file out/converge.

inn.fix.dpdx.Ro - used by inn.iter2d.umarvs to recalculate dpdx if calculation specifies a fixed Rd, or to recalculate zrotation if Ro is set and fixed Rtau is specified.

inn.iter.marvs - used by inn.iter2d.umarvs. Do 1 iteration to update the

Reynolds stress model properties. This uses
inn.iter.bij to update bij. Because of the "stiffness" of the equations, it matters how rapidly the bij equations are converged per iteration compared with momentum. Two parameters set in the primary input file to control this. They are ITERBIJ, used in inn.iter.marvs, and CBIJ used in inn.iter.bij.
inn.after - post calculation tasks. Calculate the Reynolds number, save the results on files out/varinit and out/UdUm and check for errors using inn.errorcheck, ending the run if one occurs.
inn.errorcheck - checks that the velocity converged, that the near wall point is at a y+ < 1, (using inn.yplusnw) and that the converged results are turbulent flow. Gives file out/errorcheck. The final parameter dumped is the number of errors, ERRORS. If this is > 0, look where it occurred in file out/errorcheck and then in file inn.errorcheck for suggestions.
inn.next.Ro - reinitialize some parameters and do a calculation with a different Ro.
inn.plotKA - plot U/Umean for all the Kristoffersen and Andersson rotation rates. Gives the lineplot file out/lineKAUdUm, and the plot out/KAUdUm.gif to compare with Moore & Moore 2006, FIg. 13.4.1 (included).

2. Unix instructions to run the Kasagi inlet example, Rd=9550
Bring up a terminal window and cd to chan2d.fdf.example, then
mkdir out
../../a.m4d < in.marvsRd9550 > out/print
mv out out.Rd9550

Input/Output
The primary input file, in.marvsRd9550, uses the input files described above (except for inn.next.Ro and inn.plotKA) then uses inn.iter2d.pressure to calculate the y variations of pressure due to the Reynolds stresses, before saving the results files out/varinit and out/dpdx needed for backstep.example.

3. Unix instructions to run the higher Reynolds number, Rd=40k
mkdir out
../../a.m4d < in.marvsRd40k > out/print
mv out out.Rd40k
the errorcheck file lists 1 error due to the near wall point being at a y+ of 1.06. For higher Reynolds numbers the near wall grid should be refined so

it is less than 1.

Compare results with those obtained by jgm.

Post-processing of output by jgm

Put all three out directories into out.jgm. Delete the print files (very large, 29Mb, 7Mb, 13Mb).