

# Multigrid in Firedrake

```
from firedrake import *
mesh = ...
hierarchy = MeshHierarchy(mesh, 5)
...
v = TestFunction(V)
u = Function(V)
d = u.geometric_dimension()
I = Identity(d)
F = I + grad(u) # Deformation gradient
C = F.T*F       # Right Cauchy-Green tensor
Ic = tr(C)
J = det(F)
...
# Stored strain energy
psi = lambda/2*(Ic - 3) - mu*ln(J) + lambda/2*(ln(J))**2
# Total potential energy
Pi = psi*dx - dot(B, u)*dx
F = derivative(Pi, u, v)
prob = NonlinearVariationalProblem(F, u, bcs=...)
solver = NLVSHierarchy(prob, options_prefix="foo_")
# FAS and/or PCMG options work and are hooked up
# e.g. -foo_snes_type newtonls -foo_pc_type mg -foo_npc_snes_type fas ...
solver.solve()
```

