Growth and Decay of Fully-Developed Dean Flow JESSE AULT,
JOHN DAVIS, Princeton University — Flows in curved pipes are ubiquitous in pip-
ing systems, hydraulics, and even biological systems. Beginning with the pioneering
work of Dean in the 1920s, there have been many studies of the development of flow
in curved pipes. However, the opposite problem has been little studied: the decay
of fully-developed flow in a curved pipe after exiting into a straight outlet. First,
we study the entry length of flow in a curved pipe and compare our results with
previously published work. Then, we study the problem of decay and provide a
description of the transition of the fully-developed curved-pipe flow to the fully de-
veloped flow in a straight pipe. In particular, OpenFOAM's icoFOAM solver is used
to perform direct numerical simulations in the geometry of curved pipes of varying
curvature connected with straight outlets. The magnitude of vorticity, wall shear
stress, and centerline velocity are plotted along the pipe while varying the Reynolds
number and the ratio of the pipe radius to the radius of curvature. The development
and decay lengths of the curved-pipe flow are then related to these two parameters. A
simple model for the observed dynamics will be presented.

Jesse Ault
Princeton University