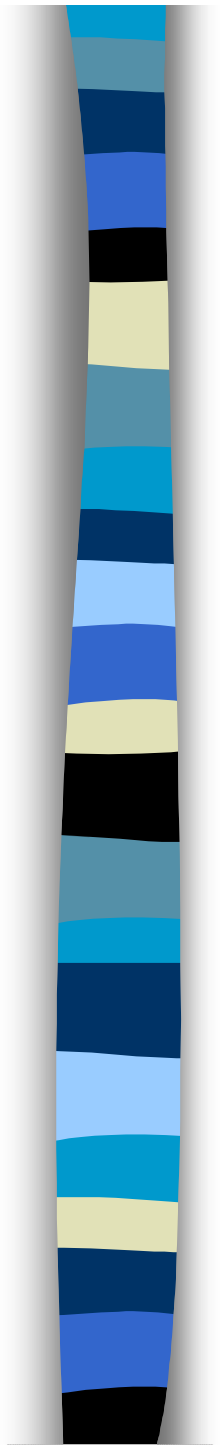


LCFI Interim results

The Mechanical Design Aspects

by

Oxford University

LCFI Interim results

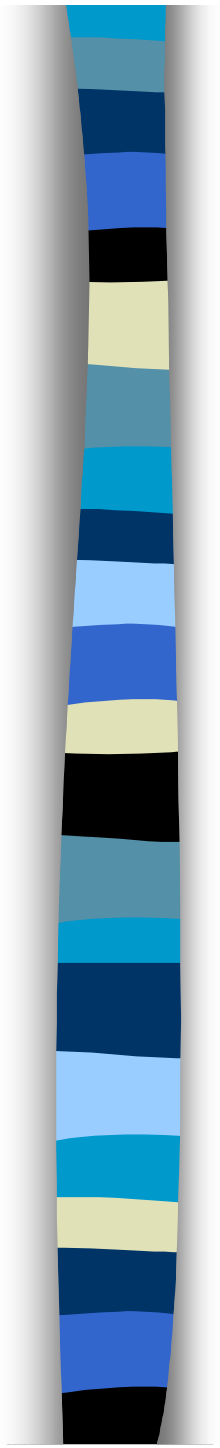
Work done in this interim period includes:

Examining the natural frequencies of the CCD plate with the end block effect

Setting up 2-D steady flow models to investigate the pressure load on the CCD due to different flow configuration. 3 hypothetical load cases were run:-

- A gap of 10mm between CCD
- A gap of 50mm between CCD
- End block thickness to include support frame effect + butt-joint at mid-span

All model with an arbitrary flow velocity of 2 m/s



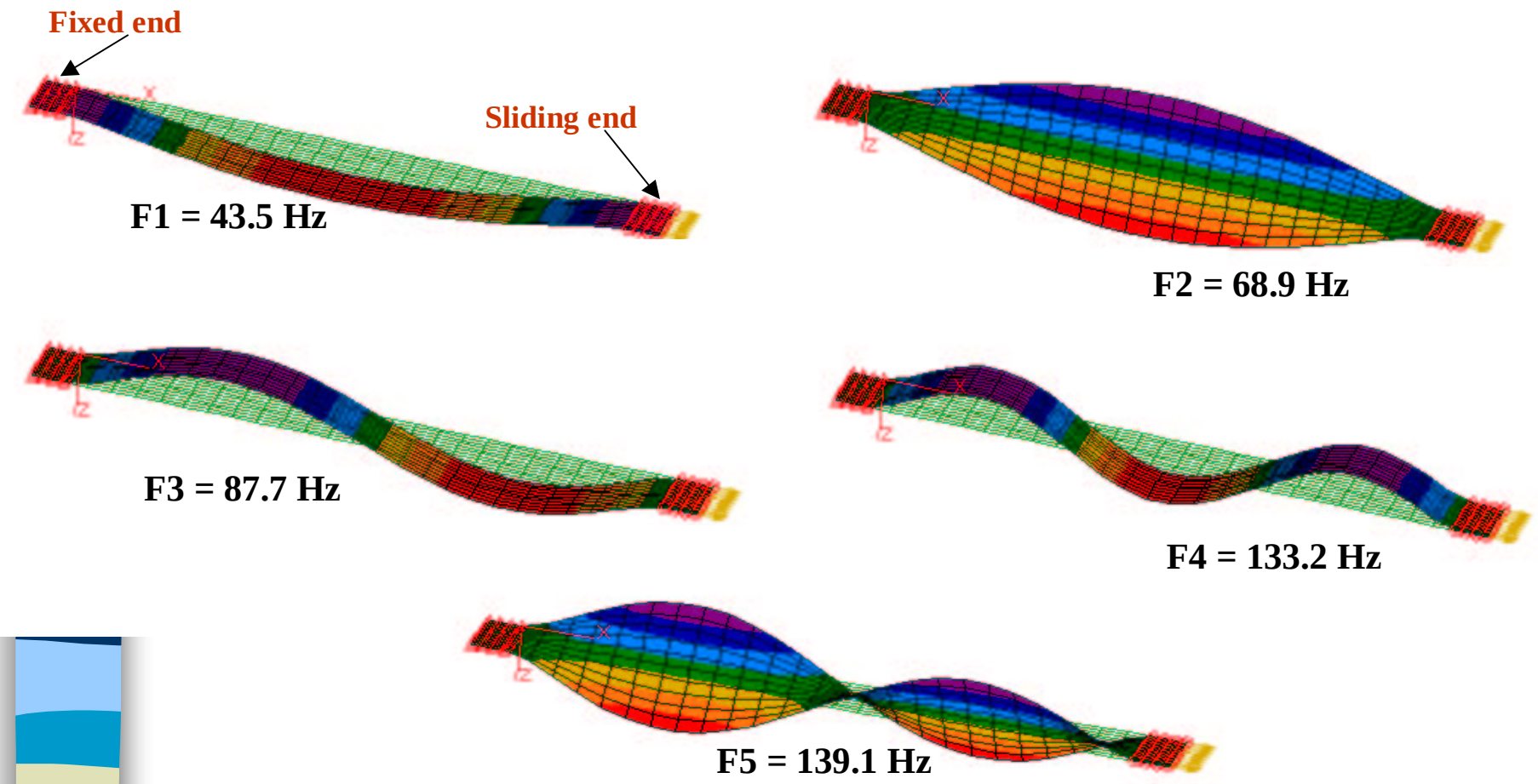
LCFI Interim results

Natural frequencies of the CCD with end blocks

End blocks of 13mm x 25mm x 2mm were attached to the two ends of the CCD. One end is fully fixed, and the other end is constrained in all translation and rotational directions except the in-plane movement.

Results show that the end constraint conditions did not affect the natural frequencies which are dominated by the in-plane pre-tensioning effect.

LCFI Interim results



Natural frequencies of a tensioned CCD with end blocks

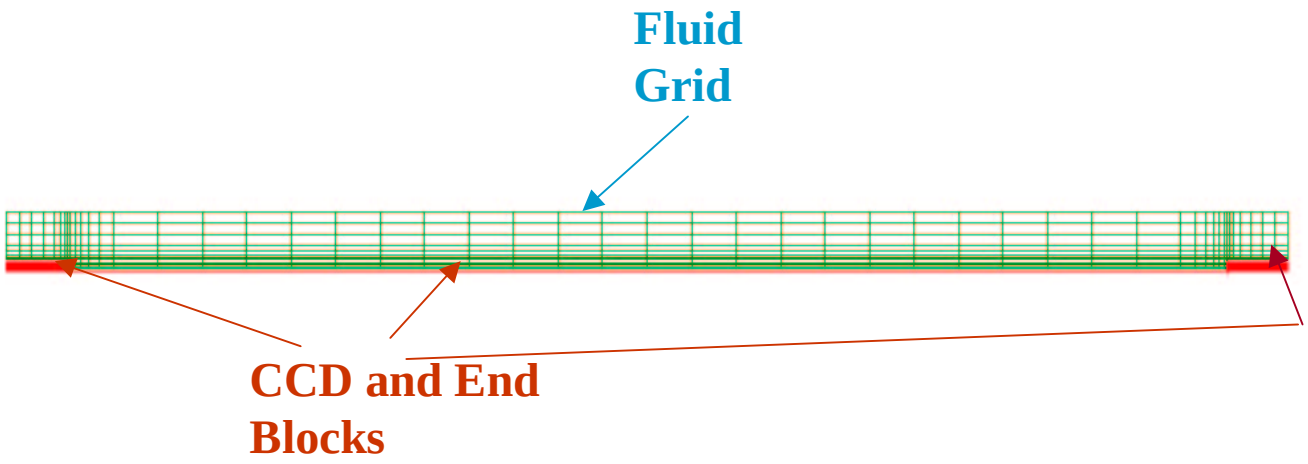
LCFI Interim results

Assumptions made in the Fluid flow simulations:

Air properties at room temp. were used throughout;

Flow velocity assumed at 2 m/s

Fluid depth was varied from 10mm to 50mm to see the boundary effect



LCFI Interim results

Case 1:

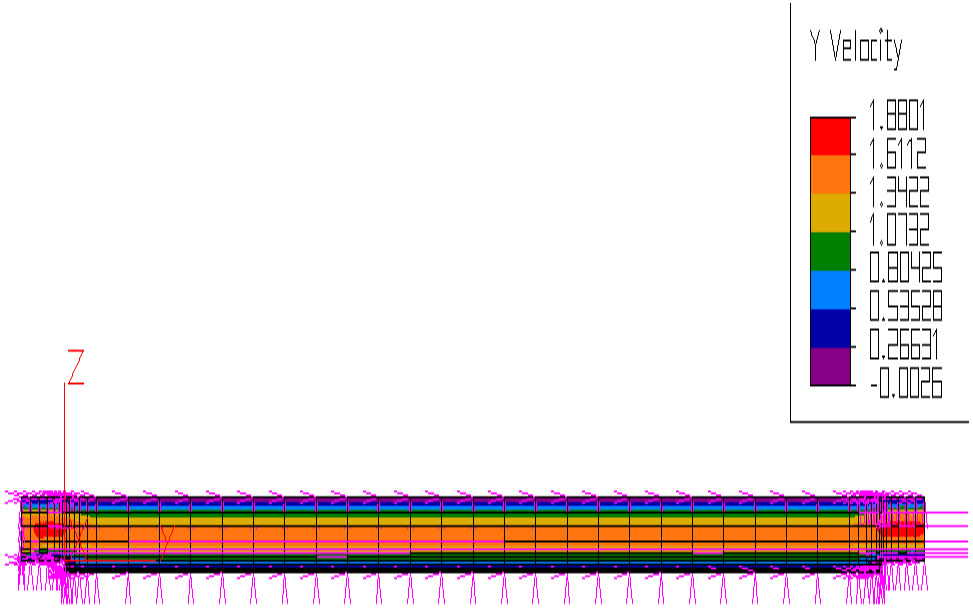
Fluid depth of 10mm with a 2mm step at end block joints:

Sequence of results:

First clip shows the horizontal flow velocity;

Second clip shows the vertical velocity (-ve value indicates formation vortex shedding),

Third clip shows the pressure build-up.



Double click on plot to view animated results

LCFI Interim results

Case 2:

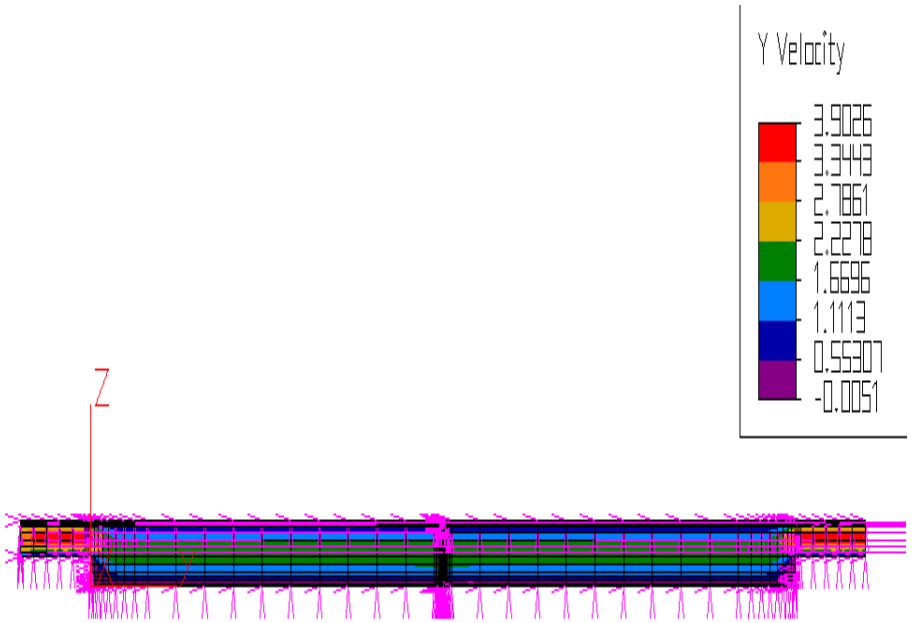
With additional blockage effect at the end blocks and the butt-joint at mid-span:

Sequence of results:

First clip shows the horizontal flow velocity;

Second clip shows the vertical velocity (-ve value indicates formation vortex shedding),

Third clip shows the pressure build-up.



Double click on the plot to view animated results

LCFI Interim results

Case 3:

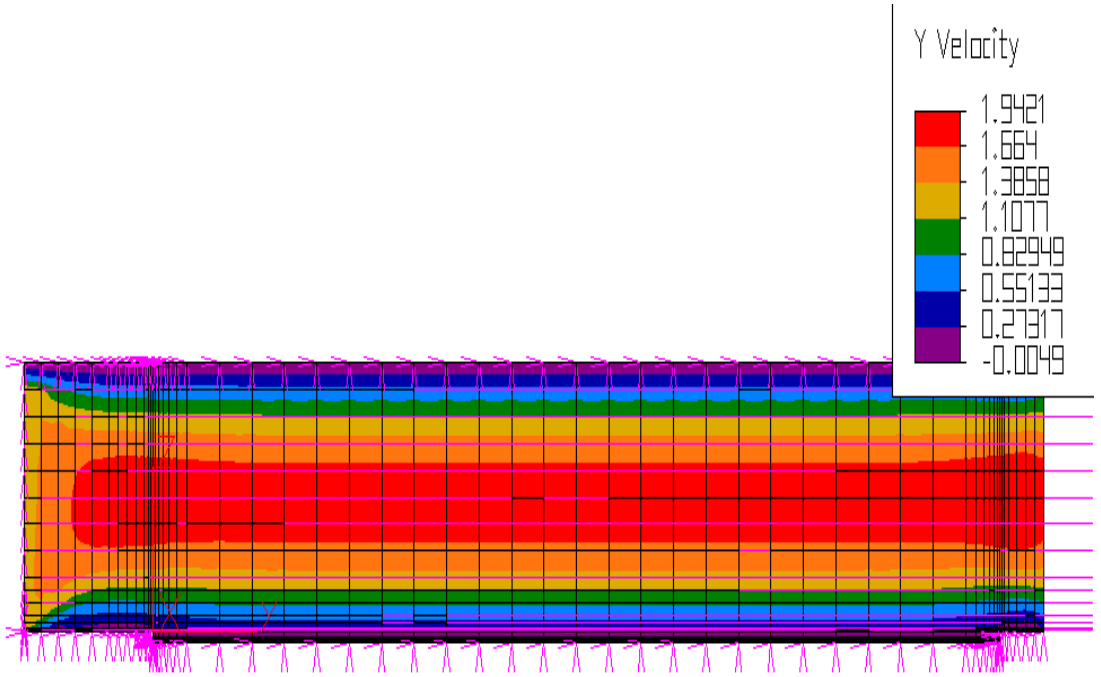
With fluid thickness increased to 50mm deep

Sequence of results:

First clip shows the horizontal flow velocity;

Second clip shows the vertical velocity (-ve value indicates formation vortex shedding),

Third clip shows the pressure build-up.



Double click on the plot to view animated results

LCFI Interim results

Summary statements:

End constraints did not change the frequencies of the tensioned CCD plate;

If the assumptions used in the modelling are correct, then the pressure built-up along the plate span is more significant than it was first thought;

The 2mm step at the end block to CCD joint seems to have some effect on the vortex formation which leads to pressure build up;

The current model did not include any “flow-restriction” effect due to the “over-hang” of adjacent CCD which could be significant if the flow is strictly not parallel to the CCD in the longitudinal direction;

Further analysis to include the blockage effect at the vicinity of the flow entrance before proceeding to 3-D modelling