

Convective and Diffusive Transport
of a
Small Cloud of Bubbles in a Micro-Channel

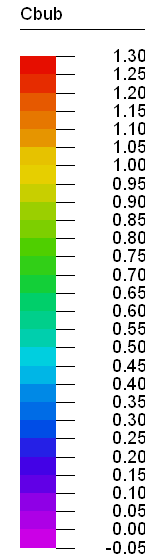
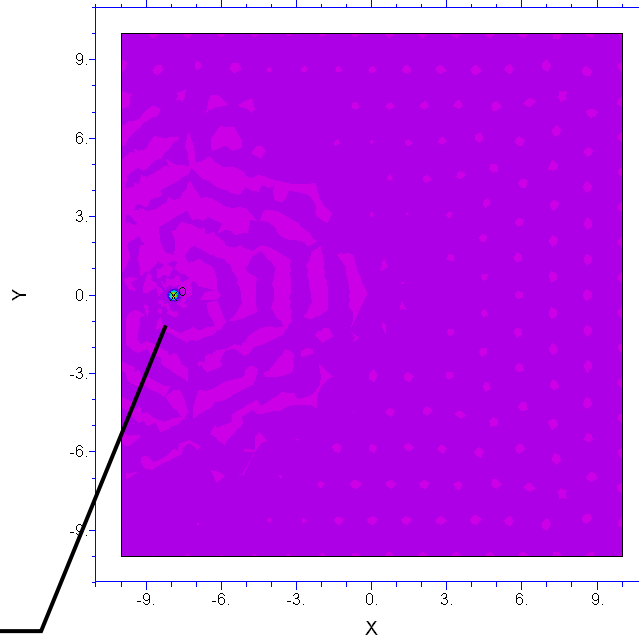
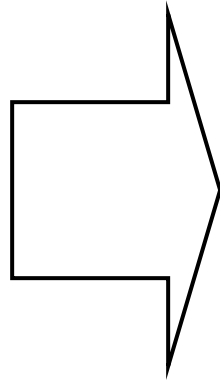
A Finite Element Analysis (FEA) using flexPDE

Craig E. Nelson - Consultant Engineer

Bubble Transport by Diffusion & Convection

10:52:58 1/8/04
FlexPDE 3.01f

Convective
Flow



Small, Spatially Gaussian
cloud of bubbles

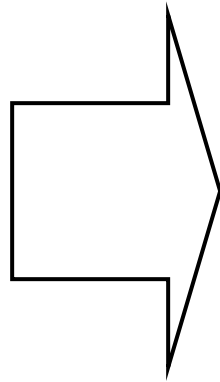
CONVECTION-DIFFUSION BASIC B: Cycle=22 Time= 1000.0 dt= 137.28 p2 Nodes=1081 Cells=510
Re= 0.040000 Integral= 0.095814

T = 1 second

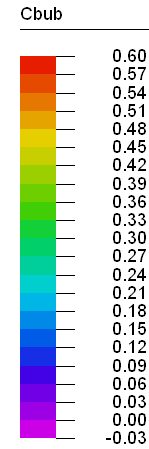
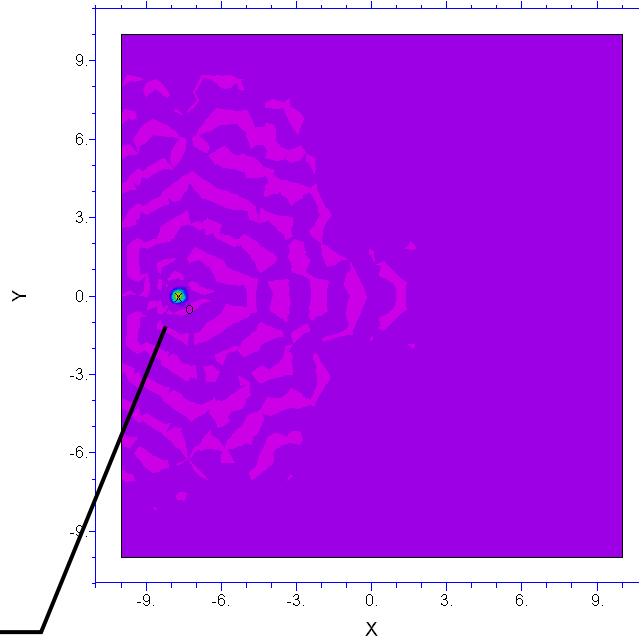
Bubble Transport by Diffusion & Convection

10:52:58 1/8/04
FlexPDE 3.01f

Convective
Flow



Diffusively Growing,
Spatially Gaussian cloud of
bubbles



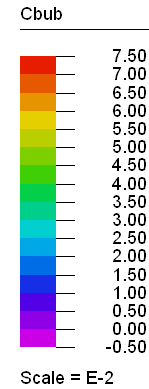
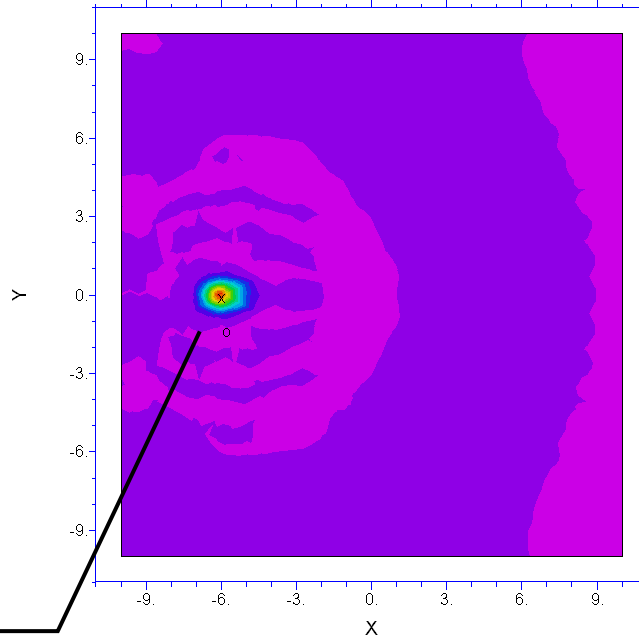
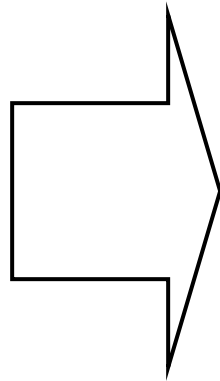
CONVECTION-DIFFUSION BASIC B: Cycle=33 Time= 3000.0 dt= 243.67 p2 Nodes=1037 Cells=48:
Re= 0.040000 Integral= 0.095803

$T = 3$ seconds

Bubble Transport by Diffusion & Convection

10:52:58 1/8/04
FlexPDE 3.01f

Convective
Flow



Diffusively Growing,
Spatially Gaussian cloud of
bubbles

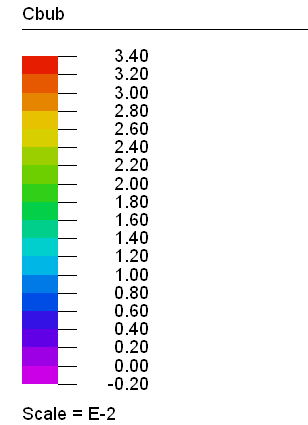
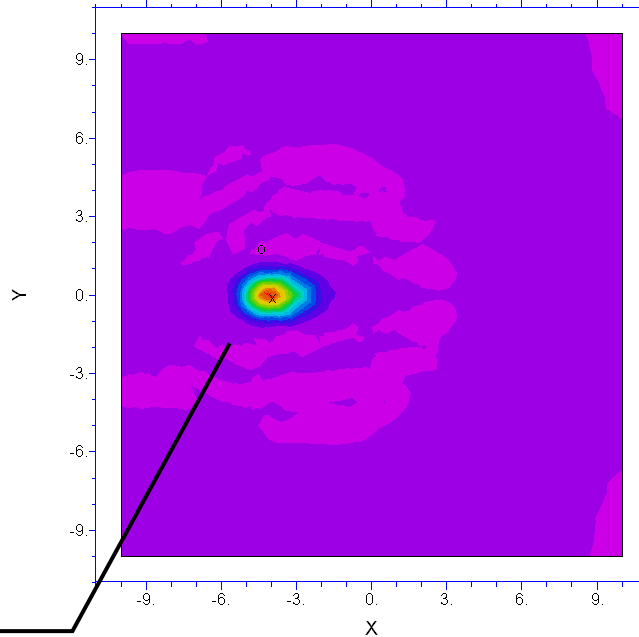
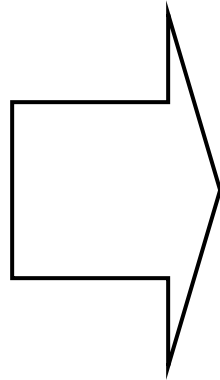
CONVECTION-DIFFUSION BASIC B: Cycle=70 Time= 20000. dt= 727.01 p2 Nodes=1017 Cells=47:
Re= 0.040000 Integral= 0.095514

T = 20 seconds

Bubble Transport by Diffusion & Convection

10:52:58 1/8/04
FlexPDE 3.01f

Convective
Flow



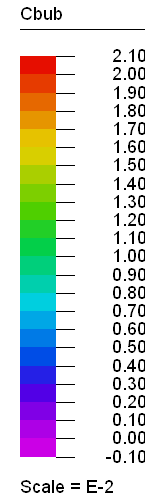
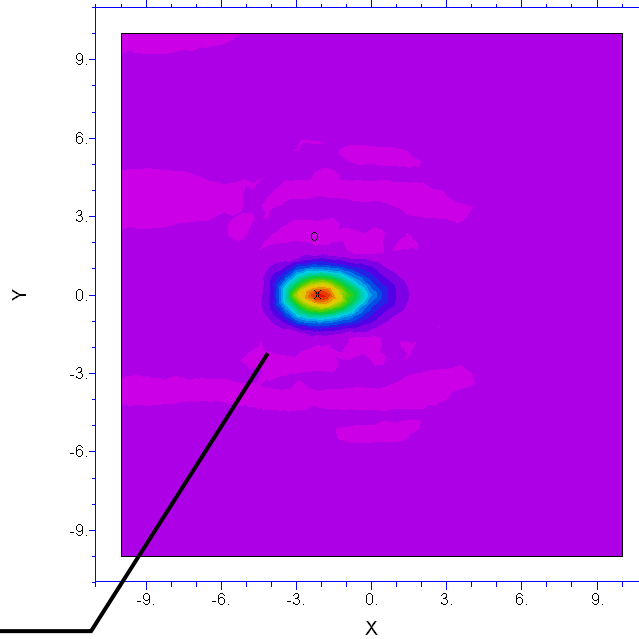
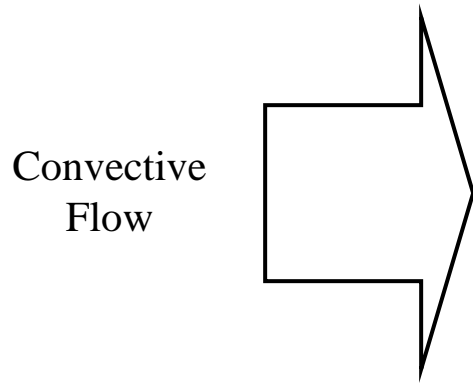
Diffusively Growing,
Spatially Gaussian cloud of
bubbles

CONVECTION-DIFFUSION BASIC B: Cycle=91 Time= 40000. dt= 1165.0 p2 Nodes=1025 Cells=48:
Re= 0.040000 Integral= 0.095621

T = 40 seconds

Bubble Transport by Diffusion & Convection

10:52:58 1/8/04
FlexPDE 3.01f

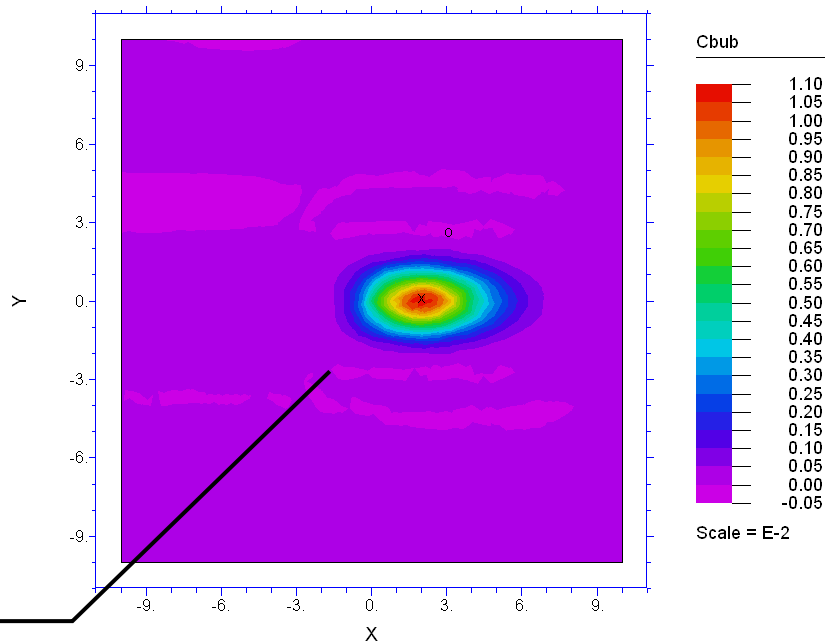


Diffusively Growing,
Spatially Gaussian cloud of
bubbles

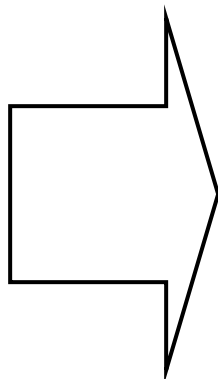
CONVECTION-DIFFUSION BASIC B: Cycle=105 Time= 60000. dt= 1508.3 p2 Nodes=1049 Cells=4:
Re= 0.040000 Integral= 0.095799

T = 60 seconds

Bubble Transport by Diffusion & Convection



Convective
Flow



Diffusively Growing,
Spatially Gaussian cloud of
bubbles

CONVECTION-DIFFUSION BASIC B: Cycle=125 Time= 1.0000e+5 dt= 2549.5 p2 Nodes=973 Cells:
Re= 0.040000 Integral= 0.095986

T = 100 seconds