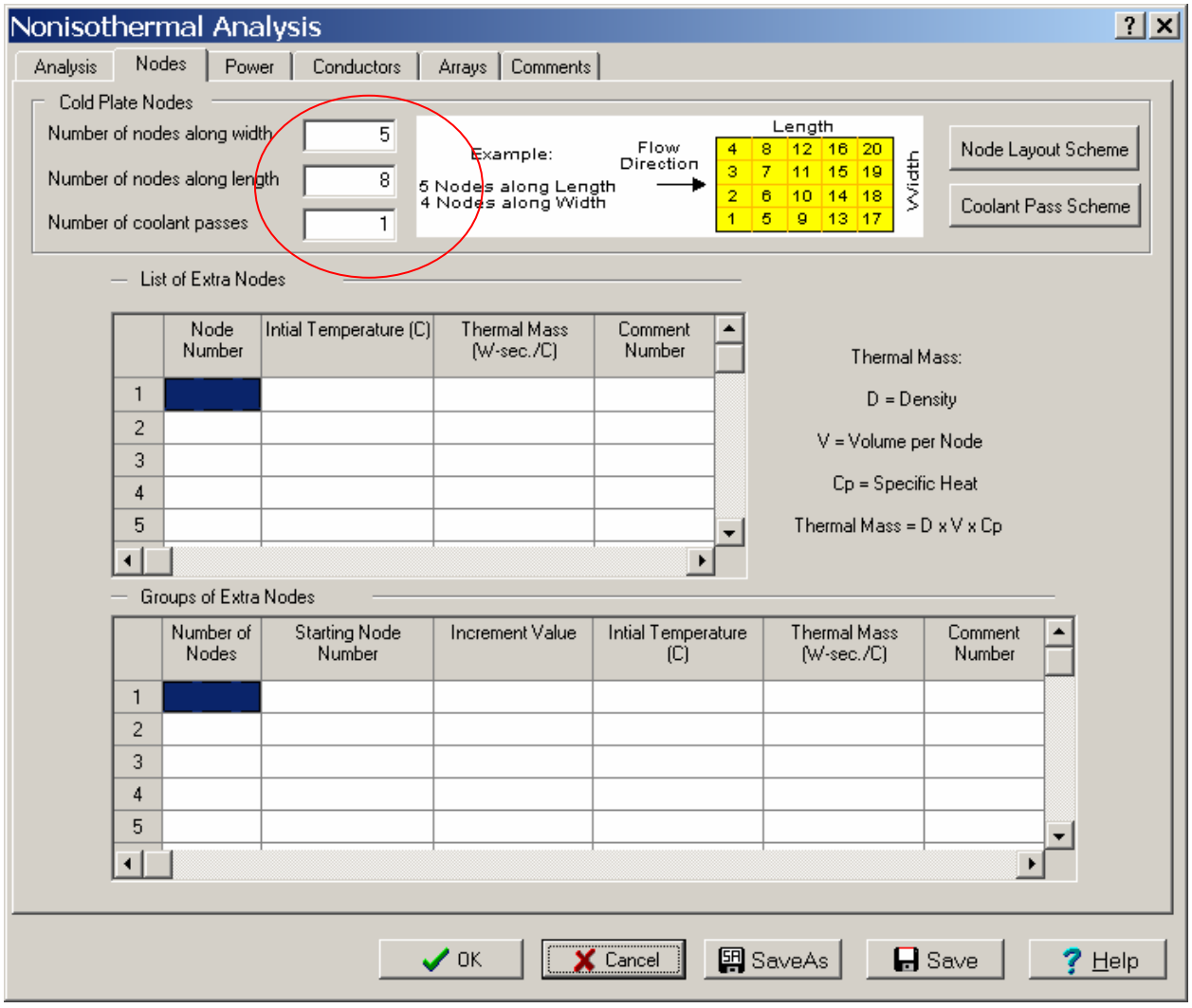
Non-isothermal Analysis Example with Uniform Power

This example builds on the Simple Example problem. In this example the cold plate is broken into a model with 8 nodes along the length and 5 nodes along the width. The model is then run to predict the temperature at each node.

Below is all that has to be done to the **Simple Example** to define the nodal breakup and run the model.



The isothermal results are shown below; they are always calculated prior to the non-isothermal analysis and are used as input to the non-isothermal analysis.

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                        HEATING ON ONE SIDE ONLY

************************ VARIABLE INPUTS ************************
THE TYPE OF FINS SPECIFIED ARE:                      RECTANGULAR
FIN HEIGHT, INCHES                                         0.500
BASE THICKNESS, INCHES                                     0.062
FIN THICKNESS, INCHES                                      0.0060
FIN DENSITY, FINS PER INCH                                 8.0
STATIC INLET FLUID TEMPERATURE, DEG C                     55.0
INLET PRESSURE, LBS/IN2                                   14.70
VOLUME FLOWRATE, FT3/MIN                                  50.00
THE POWER APPLIED TO ONE SIDE ONLY, WATTS                250.00
THE COOLING FLUID IS:                              AIR

**************** INTERMEDIATE CALCULATED PARAMETERS ****************
FREE FLOW CROSS SECTIONAL AREA, IN2                        3.62
HYDRAULIC DIAMETER, INCHES                                 0.192
COLDPLATE WEIGHT, LBS                                      0.75
TOTAL MASS FLOWRATE, LBS/MIN                               3.31
COLD PLATE MASS FLOWRATE, LBS/MIN                          3.31
COLDPLATE VOL FLOWRATE, [GAL/MIN] FT3/MIN [   374.0]      50.00
COLDPLATE VELOCITY, FT/SEC                                33.17
REYNOLDS NUMBER                                         2644.
EQUIVALENT FRICTION LOSS COEFFICIENT, KFRICTION            1.67
INLET LOSS COEFFICIENT, KINLET                             0.82
EXIT LOSS COEFFICIENT, KEXIT                              -0.73
FILM COEFFICIENT, [BTU/(HR-FT2-F)] W/(IN2-C)  [   8.22]    0.0301
THE FIN EFFICIENCY WITH HEAT ON ONE SIDE ONLY IS           0.796

*************************** PRESSURE ****************************
INLET PRESSURE, [LB/IN2] INCHES-H2O      [ 14.700]       407.077
INLET PRESSURE DROP, INCHES-H2O                            0.196
ACCELERATION PRESSURE DROP, INCHES-H2O                     0.013
FRICTIONAL PRESSURE DROP, INCHES-H2O                       0.363
EXIT PRESSURE DROP, INCHES-H2O                            -0.182
TOTAL PRESSURE DROP, INCHES-H2O                            0.390
EXIT PRESSURE, [LB/IN2] INCHES-H2O       [ 14.686]       406.687
DENSITY RATIO TIME PRESSURE DROP, INCHES-H20               0.3375

********************** THERMAL RESISTANCE ***********************
THERMAL RESISTANCE FROM INLET FLUID TO COLDPLATE, C/W      0.090
THERMAL RESISTANCE FROM LOCAL FLUID TO COLDPLATE, C/W      0.068

************************** TEMPERATURES *************************
STATIC INLET FLUID TEMPERATURE, DEG C                     55.0
STAGNATION FLUID TEMP RISE ALONG COLDPLATE, DEG C          9.9
TOTAL STAGNATION FLUID TEMP RISE, DEG C                    9.9
STATIC EXIT FLUID TEMPERATURE, DEG C                      64.9
ISOTHERMAL COLDPLATE TEMPERATURE, DEG C                   77.4
MAXIMUM COLDPLATE TEMPERATURE, DEG C                      81.9
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The temperature at each node on the cold plate and fluid are calculated and shown below. Note that since the power is uniformly distributed, the temperature from side to side is the same. The next example will demonstrate what happens when the power is not uniformly distributed.

INLET FLUID TEMPERATURE= 55.0 C

CP TEMP / FLD TEMP / POWER / NODE NO.					
	74.5 (56.3) 6.25W N 1	74.5 (56.3) 6.25W N 2	74.5 (56.3) 6.25W N 3	74.5 (56.3) 6.25W N 4	74.5 (56.3) 6.25W N 5
	75.1 (57.6) 6.25W N 6	75.1 (57.6) 6.25W N 7	75.1 (57.6) 6.25W N 8	75.1 (57.6) 6.25W N 9	75.1 (57.6) 6.25W N 10
	76.0 (58.9) 6.25W N 11	76.0 (58.9) 6.25W N 12	76.0 (58.9) 6.25W N 13	76.0 (58.9) 6.25W N 14	76.0 (58.9) 6.25W N 15
	77.1 (60.1) 6.25W N 16	77.1 (60.1) 6.25W N 17	77.1 (60.1) 6.25W N 18	77.1 (60.1) 6.25W N 19	77.1 (60.1) 6.25W N 20
	78.2 (61.3) 6.25W N 21	78.2 (61.3) 6.25W N 22	78.2 (61.3) 6.25W N 23	78.2 (61.3) 6.25W N 24	78.2 (61.3) 6.25W N 25
	79.3 (62.6) 6.25W N 26	79.3 (62.6) 6.25W N 27	79.3 (62.6) 6.25W N 28	79.3 (62.6) 6.25W N 29	79.3 (62.6) 6.25W N 30
	80.2 (63.8) 6.25W N 31	80.2 (63.8) 6.25W N 32	80.2 (63.8) 6.25W N 33	80.2 (63.8) 6.25W N 34	80.2 (63.8) 6.25W N 35
	80.8 (64.9) 6.25W N 36	80.8 (64.9) 6.25W N 37	80.8 (64.9) 6.25W N 38	80.8 (64.9) 6.25W N 39	80.8 (64.9) 6.25W N 40

FLUID TEMPERATURE OUT= 64.9

AVERAGE COLDPLATE TEMP.= 77.6
POWER DIRECTLY ON CP= 250.00
NO. OF ITERATIONS REQUIRED= 17
ALLOW. NO. OF ITERATIONS= 1000
TEMP. RELAXATION CRITERIA=.00100
PERCENT ENGERY BALANCE= 0.0013