The README.docx was written by Zhiming Gao (Phone: 865-946-1339, email: gaoz@ornl.gov) The detailed model are reported in the manuscript of “*An Open-Source Code for Modeling and Simulation of Membrane-Based Dehumidification and Energy Recovery.*”

**Document file**

The zipped files include two folders: **CODE\_MODEL** and **CASES**. In the folder of **CODE\_MODEL**, there are totally fifteen source-code files. The source-code files were written in C++. The functions are explained in the Code function.

In the folder of **CASE**, there are ten files which include one executable file and 9 input text files for case studies.

* Membrane\_Model.exe is an executable file which can be generated from the source codes in the folder of code\_model. The used compiler is Microsoft Visual Studio Community 2015. The executable file can be used directly to study any cases with the format of the attached input files.
* 9 input files for case studies include a2a104\_s3\_cr.txt, a2a520\_s3\_cr.txt, a2v360\_caseA\_cr.txt, a2v360\_caseB\_cr.txt, a2v360\_caseC\_cr.txt, a2v360\_caseD\_cr.txt, a2v360\_caseE\_cr.txt, a2v360\_caseF\_cr.txt, a2a360\_caseG\_cr.txt. Here, a2a104\_s3\_cr.txt and a2a520\_s3\_cr.txt are the input files for the AIR-AIR cases, and the input file can used to repeat the results reported in Figures 8-10 of the manuscript; and a2v360\_caseA\_cr.txt et.al. are the input files for the AIR-vapor cases where the permeate side is under the condition of vacuum, and these input file can used to repeat the results reported in Figures 4-7 of the manuscript.

**Code function**

Cmatric.cpp : The defined routines are used to allocating memory for any variables used in the open-source codes.

Component.cpp : The defined Class is used to carry out a general heat exchanger component simulation based segment-by segment methodology for various flow configurations.

HXM.cpp : The defined Class is used to reanalyze heat exchanger parameters and geometry size, segment size, characteristic length.

Iofile.cpp : The defined namespace is used to read input data file and generate out data file.

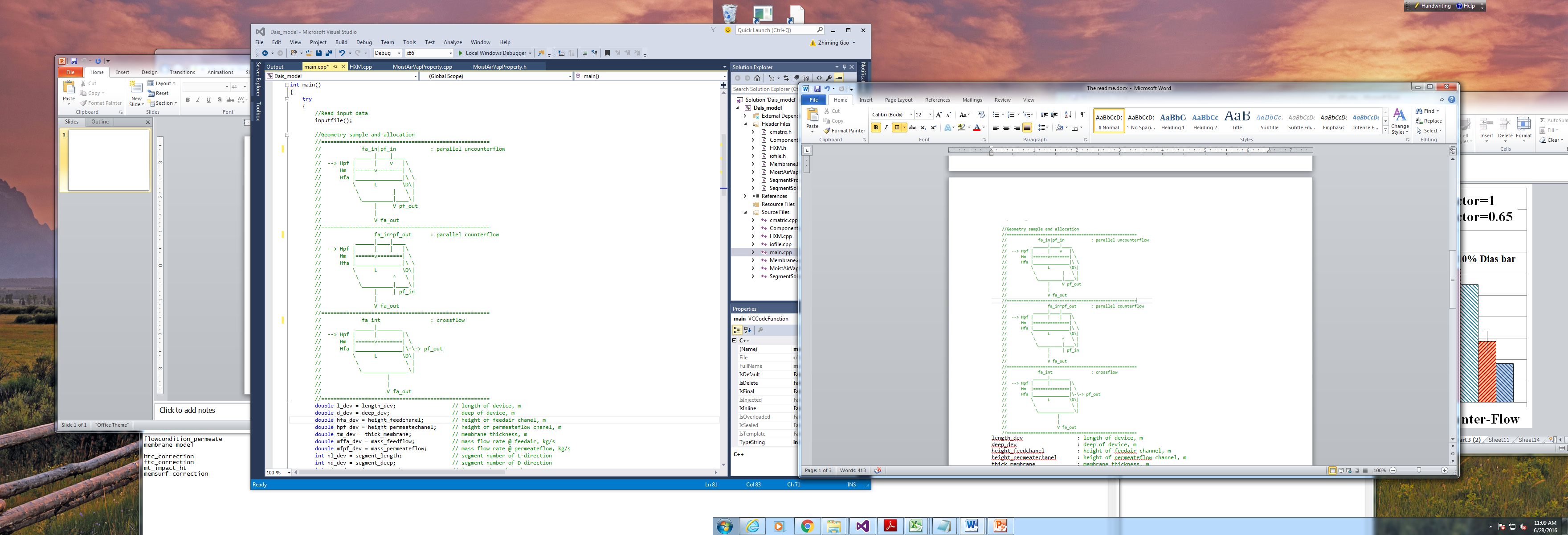
Main.cpp : This is a Main function to call other functions.

Membrane.cpp : The namespace of Membrane is defined and is used to calculate membrane mass transport analysis.

MoistAirVapProperty.cpp : The namespace of MoistAirVapProperty is defined and is used to calculate moist air and vapor properties, and their heat transfer coefficients. .

SegmentSolve.cpp : The defined Class is used to the heat and mass transport process in feed-side and permeate-side flow for each segment. The solving method is Gaussian elimination.

**Input parameter introduction**



length\_dev : length of device, m

deep\_dev : deep of device, m

height\_feedchanel : height of feedair channel, m

height\_permeatechanel : height of permeateflow channel, m

thick\_membrane : membrane thickness, m

segment\_length : segment number of L-direction

segment\_deep : segment number of D-direction

layernum\_membrane : layer number of membrane

flowtype\_device : flow configuration: 1: parallel uncounterflow; 2:parallel counterflow; 0 or 3 or other: crossflow

poreradius\_membrane : pore radius of membrane,m (need it if membrane\_model=0)

porosity\_membrane : porosity of membrane,(-) (need it if membrane\_model=0)

tortuosity\_membrane : tortuosity of membrane,(-) (need it if membrane\_model=0)

thermocond\_membrane : membrane thermocondivity,kW/m-K(need it if membrane\_model=0)

mass\_feedflow : mass flow rate @ feedair, kg/s

temp\_feedflow : feedair temp, K

rh\_feedflow : rh@feedair, (dimensionless)

press\_feedflow : feedair pressure, Pa

mass\_permeateflow : mass flow rate @ permeateflow, kg/s

temp\_permeateflow : peameateflow temp, K

rh\_permeateflow : rh@peameateflow, (dimensionless)

press\_permeateflow : peameateflow pressure, Pa

flowcondition\_permeate : 0:A2V,vapor only in permeateflow; 1:A2A,air in permeateflow

membrane\_model : 0: default model; 1: Dais data; 2 constant value-model

htc\_correction : HTC correction (0-1), (-)

ftc\_correction : FTC correction (0-1), (-)

mt\_impact\_ht : 0: not enabled; 1: enabled mass permeated on ht impact

memsurf\_correction : membrane surface deflection (0-inf, 1 means perfectly flat)

**Output parameter introduction**

**General outputs:**

tfa\_in(c) : feedair temp @inlet

tfa\_out(c) : feedair temp @outlet

humidfa\_in(kg/kg) : feedair humidity ratio @inlet

humidfa\_out(kg/kg) : feedair humidity ratio @outlet

rhfa\_in : feedair RH @inlet

rhfa\_out : feedair RH @outlet

Pvapfa\_in(pa) : feedair vapor pressure @inlet

Pvapfa\_out(pa) : feedair vapor pressure @outlet

tpf\_in(c) : permeateflow temp @inlet

tpf\_out(c) : permeateflow temp @outlet

humidpf\_in(kg/kg) : permeateflow humidity ratio @inlet

humidpf\_out(kg/kg) : permeateflow humidity ratio @outlet

rhpf\_in : permeateflow RH @inlet

rhpf\_out : permeateflow RH @outlet

Pvappf\_in(pa) : permeateflow vapor pressure @inlet

Pvappf\_out(pa) : permeateflow vapor pressure @outlet

**Parallel and counter flows**

X/L\_index : segment index

tfa(c) : feedair temp

tfam(c) : temp of interfacial membrane at feedair-side

humidfa(kg/kg) : feedair humidity ratio

pvapfa(pa) : feedair vapor pressure

flfa(kg/s)@per\_segment\_per\_channel: feedair flow rate per\_segment\_per\_channel

tpf(c) : permeateflow temp

tpfm(c) : temp of interfacial membrane at permeateflow-side

humidpf(kg/kg) : permeateflow humidity ratio

pvappf(pa) : permeateflow vapor pressure

flpf(kg/s)@per\_segment\_per\_channel : permeateflow flow rate per\_segment\_per\_channel

vappermeat(kg/m2/s) from feed-side to permeate-side @per\_segment\_per\_channel: permeated vapor rate @per\_segment\_per\_channel

**Crossflow**

D/L\_index : segment index in D/L directions

Tfa (c)\_map : feedair temp

tfam(c)\_map : temp of interfacial membrane at feedair-side

humidfa(kg/kg)\_map : feedair humidity ratio

pvapfa(pa)\_map : feedair vapor pressure

flfa(kg/s)\_map@per\_segment\_per\_channel: feedair flow rate per\_segment\_per\_channel

tpf(c)\_map : permeateflow temp

tpfm(c)\_map : temp of interfacial membrane at permeateflow-side

humidpf(kg/kg)\_map : permeateflow humidity ratio

pvappf(pa)\_map : permeateflow vapor pressure

flpf(kg/s)\_map @per\_segment\_per\_channel : permeateflow flow rate per\_segment\_per\_channel

vappermeat(kg/m2/s)\_map from feed-side to permeate-side @per\_segment\_per\_channel: permeated vapor rate @per\_segment\_per\_channel