```
// Type234.cpp
// ------------------------------------------------------------------------
// Solution to a linear differential equation of 1st order under TRNSYS
// environment for building dynamic thermal behaviour of monozone while
// considering adiabatic boundary conditions
//
// Created by Dr. Wen HU on July 13, 2008.
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// ------------------------------------------------------------------------
//                dT
// (rho*cp*volume)----=(rho*cp*qa_in)*ta_in+pw_in-(rho*cp*qa_in)*T
//                dt
//  ------------------------------------------------------------------------
//  variables informations:
//  -----------------------
//  Parameters: (Number=4)
//  ----------
//  rho    - Constant air density          [kg/m3]
//  cp     - Constant air specific heat    [kJ/kg]
//  volume - Room air volume               [m3]
//  ta_ini - Room initial air temperature  [°C]
//
//  Inputs: (Number=3)
//  -------
//  qa_in  - Volumetric air flow rate      [m3/h]
//  ta_in  - Supply air flow temperatre    [°C]
//  ta_out - Room interior air temperature [°C]
//
//  Outputs: (Number=1)
//  --------
//  ta_out - Final room air temperature    [°C]
//
//------------------------------------------------------------------------
#include <cmath>
#include <iostream>
#include <TRNSYS.h>

using namespace std;
extern "C" __declspec(dllexport)
//------------------------------------------------------------------------
int TYPE234 (double &time, double xin[], double out[],double &t,
             double &dtdt, double par[], int info[],  int icntrl)
//------------------------------------------------------------------------
{
    //Declare system variables
    double time0,tfinal,delt;
    int iunit,itype;

    //Declare storage array
    double store[2];

    //Declcare inputs,outputs and parameters
    double ta_in,pw_in,qa_in;
    double ta_out;
    static double volume, cp, rho,ta_ini;

    //Declcare internal variables
```

```
    static double c1, c2, cstep;
    double temp;

    //Define the number of inputs,outputs and parameters
    int ni=3;
    int no=1;
    int np=4;
    int nd=0;
    int ns=2;

    //Specify variables' units for checking
    char*  ycheck[3]={"TE1","PW2","VF1"};
    char*  ocheck[1]={"TE1"};

    //TRNSYS function for time control
    time0=getSimulationStartTime();
    tfinal=getSimulationStopTime();
    delt=getSimulationTimeStep();

    //Introduce inputs' variables
    ta_in=xin[0];
    pw_in=xin[1];
    qa_in=xin[2];

    //Set TRNSYS version information 16.1
    if (info[6]==-2)
    {
       info[11]=16;
       return 1;
    }

    //Very first call operations
    if (info[6]==-1)
    {
        int iopt=1;
        info[5]=no;
        typeck(&iopt,info,&ni,&np,&nd);
        rcheck(info,ycheck,ocheck);

        //Reserve space in the storage structure
        setStorageSize(&ns,info);

        return 1;
    }

    //Perform initial timestep manipulations
    if (time <(time0+delt/2.0))
    {
        iunit=info[0];
        itype=info[1];

        //pre-calculated variables
        volume=par[0];
        cp=par[1];
        rho=par[2];
        ta_ini=par[3];
```

```
        cstep=delt*3600;
        c1=rho*cp*volume*1000/cstep;
        c2=qa_in/3600*rho*cp*1000;

        //Set initial values for storage array
        store[0]=ta_ini;
        store[1]=ta_ini;
        setStorageVars(store,&ns,info);

        return 1;
    }

    //Perform post convergence manipulations
    if (info[12]>0)
    {
        getStorageVars(store,&ns,info);
        store[0]=store[1];
        setStorageVars(store,&ns,info);
        return 1;
    }

    //Calculate the interior room air temperature
    getStorageVars(store, &ns,info);
    temp=store[0];
    ta_out=(c1*temp+c2*ta_in+pw_in)/(c1+c2);
    store[1]=ta_out;
    setStorageVars(store,&ns,info);

    //Outputs assignement
    out[0]=ta_out;

    //Subroutine End
    return 1;
}
```

```
*****************************************************************************
* TYPE234.DCK
* DECK FOR TYPE234.CPP TESTING
* CREATED BY WEN HU ON JULY 13, 2008
*****************************************************************************
VERSION 16.1

ASSIGN  RESULT.TXT 32

CONSTANTS 3
STEP=1
START=1
STOP=784
*-----------------------------------------------------------------------------
CONSTANTS 4
VOLUME=400
CP=1.083
RHO=1.20
TA_INI=15

EQUATIONS 3
TA_IN=25+10*INT(ABS(SIN(TIME))+0.5)
PW_IN=0
QA_IN=40
*-----------------------------------------------------------------------------
SIMULATION START STOP STEP
*-----------------------------------------------------------------------------
UNIT 10 TYPE 234
PARAMETERS 4
VOLUME CP RHO TA_INI
INPUTS 3
TA_IN PW_IN  QA_IN
20    20     20
*-----------------------------------------------------------------------------
UNIT 30 TYPE 65 PLOTTER
PARAMETERS 12
2 0 0 50 0 50 1 10 0 0 0 0
INPUTS 2
TA_IN  10,1
TA_IN  TA_OUT
LABELS 3
TEMPERATURE[C]
TEMPERATURE[C]
EVOLUTION
*-----------------------------------------------------------------------------
UNIT 50 TYPE 25 PRINTER
PARAMETERS 10
STEP START STOP 32 2 1 -1 -1 1 -1
INPUTS 1
10,1
TA_OUT
FORMAT (1X,10F15.5)
*-----------------------------------------------------------------------------
END
```