INVERSE HEAT CONDUCTION Ill-posed Problems

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Heat conduction Matlab function for the X22B(y-t1)0Y22B00T0 case using a piecewise-uniform approximation (pua): **fdX22By_t10Y22B00T0_pua.m**

Syntax

```
fdX22By_t10Y22B00T0_pua(xd,yd,Wd,td,p,A,N)
```

Description

fdX22By_t10Y22B00T0_pua (*xd*, *yd*, *Wd*, *td*, *p*, *A*, *N*) returns the dimensionless temperature *Td* at a given dimensionless location (*xd*, *yd*) with *xd* between 0 and 1, and *yd* between 0 and *Wd*, and at a given dimensionless time *td*, when a space variation of the surface heat flux having *p* as an exponent (positive or negative) is applied. Also, it calls the fdX22By1pt10Y22B00T0 (*xd*, *yd*, *Wd*, *td*, *W0d*, *A*) building block function that is computed with an accuracy of 10^{-A} (*A* = 2, 3, …, 15), while *N* indicates the number of space steps chosen up to the dimensionless width *Wd* of the rectangle.

If *xd*, *yd* and *td* are not single values but arrays (length(*xd*) = *m*, length(*yd*) = *n* and length(*td*) = *p*) defining the dimensionless coordinates and times of interest, the above function returns the dimensionless temperature *Td* as a 3D subscripted array, where size(*Td*) = [*m*, *n*, *p*].

Examples

Example 1

```
>> Td=fdX22By_t10Y22B00T0_pua(0,.5,2,.5,2,5,10)

Td =

   0.466634272163739
```

Example 2

```
>> Td=fdX22By_t10Y22B00T0_pua(0,.5,2,.5,-2,5,10)
```

```
Td =

   14.212149465147677
```

Example 3

```
>> xd=[0 1]'

xd =

     0
     1

>> yd=[0 .5 1.5]'

yd =

                   0
   0.500000000000000
   1.500000000000000

>> td=[0.01 .1  1]'

td =

   0.010000000000000
   0.100000000000000
   1.000000000000000

>> Td=fdX22By_t10Y22B00T0_pua(xd,yd,2,td,2,5,10)

Td(:,:,1) =

   0.001438498644409   0.029105275210661   0.254779953447432
   0.000000000000000   0.000000000000007  -0.000000001072891(*)


Td(:,:,2) =

   0.025288028187088   0.113941620521093   0.808782286117968
   0.001303166754874   0.003273229142652   0.017633713260029


Td(:,:,3) =

   0.812341891049201   1.038069426902592   2.481997054327778
   0.729047641273240   0.833322321430750   1.383268066282729
```

(*) The negative numerical value of `-0.000000001072891` for the dimensionless temperature computed at `xd=1`, `yd=1.5` and `td=0.01` seems to be physically not consistent as the temperature has to be always positive. However, it is right as it is consistent with the accuracy of `A=5` chosen for the building block. In other words, only five decimal places have to be considered in the above numerical value according to `A=5`. In fact, if `A=15` is chosen, it results in

```
>> Td=fdX22By_t10Y22B00T0_pua(xd,yd,2,td,2,15,10)

Td(:,:,1) =

   0.001438498659983   0.029105275210802   0.254779957432340
   0.000000000000002   0.000000000000016   0.000000000000135


Td(:,:,2) =

   0.025288037917165   0.113941626797453   0.808782281775977
   0.001303166687659   0.003273228024583   0.017633713823964


Td(:,:,3) =

   0.812341898832315   1.038069431669857   2.481997051509270
   0.729047639250796   0.833322318795142   1.383268068360678
```