1950:

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 1:

Plot:



Best alpha: 2.8

Best tau: 0.5

Minimize with the Inf-norm

Diffprev= 2.0111

Steps 0.75 times previous

Alpha=0:0.1:5 starting

Tau=0:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 3 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 2:

Plot:



Best alpha: 2.7999

Best tau: 0.5082

Minimize with the Inf-norm

Diffprev= 1.9603

Steps 0.65 times previous

Alpha=0:0.1:3 starting

Tau=0:0.1:1 starting

750 compare points

Max iterations: 7

Stopped at 6 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 3:

Plot:



Best alpha: 1.4150

Best tau: 0.84

Minimize with the 1-norm

Diffprev= 568.6523

Steps 0.75 times previous

Alpha=0:0.1:5 starting

Tau=0:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 4 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 4:

Plot:



Best alpha: 1.4

Best tau: 0.9

Minimize with the 1-norm

Diffprev= 569.4024

Steps 0.65 times previous

Alpha=0:0.1:3 starting

Tau=0:0.1:1 starting

750 compare points

Max iterations: 7

Stopped at 3 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 5:

Plot:



Best alpha: 1.4278

Best tau: 0.8265

Minimize with the 2-norm

Diffprev= 25.6237

Steps 0.75 times previous

Alpha=0:0.1:5 starting

Tau=0:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 5 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 6:

Plot:



Best alpha: 1.4441

Best tau: 0.8196

Minimize with the 2-norm

Diffprev= 25.5858

Steps 0.65 times previous

Alpha=0:0.1:3 starting

Tau=0:0.1:1 starting

750 compare points

Max iterations: 7

Stopped at 7 iterations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1950 Start | Inf-Norm Alpha | Inf-Norm Tau | 1-Norm Alpha | 1-Norm Tau | 2-Norm Alpha | 2-Norm Tau |
| Normal | 2.8 | 0.5 | 1.4150 | 0.84 | 1.4278 | 0.8265 |
| Refined | 2.7999 | 0.5082 | 1.4 | 0.9 | 1.4441 | 0.8196 |

|  |  |  |  |
| --- | --- | --- | --- |
| 1950 Start | Inf-Norm Best Norm (Max difference) | 1-Norm Best Norm (sum of differences) | 2-Norm Best Norm (Root sum squared of differences) |
| Normal | 2.0111 | 568.6523 | 25.6237 |
| Refined | 1.9603 | 569.4024 | 25.5858 |

1960:

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 1:

Plot:



Best alpha: 2.5850

Best tau: 0.5

Minimize with the Inf-norm

Diffprev= 2.0705

Steps 0.75 times previous

Alpha=0:0.1:5 starting

Tau=0:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 3 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 2:

Plot:



Best alpha: 2.6

Best tau: 0.49

Minimize with the Inf-norm

Diffprev= 2.0431

Steps 0.65 times previous

Alpha=0:0.1:3 starting

Tau=0:0.1:1 starting

750 compare points

Max iterations: 7

Stopped at 3 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 3:

Plot:



Best alpha: 0.8697

Best tau: 1.6031

Minimize with the 1-norm

Diffprev= 592.3710

Steps 0.75 times previous

Alpha=0:0.1:5 starting

Tau=0:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 6 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 4:

Plot:



Best alpha: 0.8575

Best tau: 1.6183

Minimize with the 1-norm

Diffprev= 592.5512

Steps 0.65 times previous

Alpha=0:0.1:3 starting

Tau=1:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 5 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 5:

Plot:



Best alpha: 0.9150

Best tau: 1.5

Minimize with the 2-norm

Diffprev= 26.6883

Steps 0.75 times previous

Alpha=0:0.1:5 starting

Tau=0:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 3 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 6:

Plot:



Best alpha: 0.8950

Best tau: 1.5350

Minimize with the 2-norm

Diffprev= 26.6298

Steps 0.65 times previous

Alpha=0:0.1:3 starting

Tau=1:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 4 iterations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1960 Start | Inf-Norm Alpha | Inf-Norm Tau | 1-Norm Alpha | 1-Norm Tau | 2-Norm Alpha | 2-Norm Tau |
| Normal | 2.5850 | 0.5 | 0.8697 | 1.6031 | 0.9150 | 1.5 |
| Refined | 2.6 | 0.49 | 0.8575 | 1.6183 | 0.8950 | 1.5350 |

|  |  |  |  |
| --- | --- | --- | --- |
| 1960 Start | Inf-Norm Best Norm (Max difference) | 1-Norm Best Norm (sum of differences) | 2-Norm Best Norm (Root sum squared of differences) |
| Normal | 2.0705 | 592.3710 | 26.6883 |
| Refined | 2.0431 | 592.5512 | 26.6298 |

1950 predicting 1960-1980:

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 1:

Plot:



Best alpha: 2.4550

Best tau: 0.5

Minimize with the Inf-norm

Diffprev= 2.1715

Steps 0.75 times previous

Alpha=0:0.1:5 starting

Tau=0:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 3 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 2:

Plot:



Best alpha: 2.8

Best tau: 0.5

Minimize with the Inf-norm

Diffprev= 2.1822

Steps 0.65 times previous

Alpha=0:0.1:3 starting

Tau=0:0.1:1 starting

750 compare points

Max iterations: 7

Stopped at 3 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 3:

Plot:



Best alpha: 1.4

Best tau: 0.9

Minimize with the 1-norm

Diffprev= 612.3530

Steps 0.75 times previous

Alpha=0:0.1:5 starting

Tau=0:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 3 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 4:

Plot:



Best alpha: 1.4

Best tau: 0.9

Minimize with the 1-norm

Diffprev= 612.3530

Steps 0.65 times previous

Alpha=0:0.1:3 starting

Tau=0:0.1:1 starting

750 compare points

Max iterations: 7

Stopped at 3 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 5:

Plot:



Best alpha: 0.6820

Best tau: 1.8358

Minimize with the 2-norm

Diffprev= 28.0857

Steps 0.75 times previous

Alpha=0:0.1:5 starting

Tau=0:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 5 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 6:

Plot:



Best alpha: 0.7

Best tau: 1.7

Minimize with the 2-norm

Diffprev= 28.2362

Steps 0.65 times previous

Alpha=0:0.1:3 starting

Tau=1:0.1:2 starting

750 compare points

Max iterations: 7

Stopped at 3 iterations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1950 Start with 20 year prediction | Inf-Norm Alpha | Inf-Norm Tau | 1-Norm Alpha | 1-Norm Tau | 2-Norm Alpha | 2-Norm Tau |
| Normal | 2.4550 | 0.5 | 1.4 | 0.9 | 0.6820 | 1.8358 |
| Refined | 2.8 | 0.5 | 1.4 | 0.9 | 0.7 | 1.7 |

|  |  |  |  |
| --- | --- | --- | --- |
| 1950 Start with 20 year prediction | Inf-Norm Best Norm (Max difference) | 1-Norm Best Norm (sum of differences) | 2-Norm Best Norm (Root sum squared of differences) |
| Normal | 2.1715 | 612.3530 | 28.0857 |
| Refined | 2.1822 | 612.3530 | 28.2362 |

1950 predicting 1960-1980:

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 1:

Plot:



Best alpha: 2.6

Best tau: 0.4

Minimize with the Inf-norm

Diffprev= 2.3588

Steps 0.75 times previous

Alpha=0:0.2:10 starting

Tau=0:0.2:15 starting

500 compare points

Max iterations: 8

Stopped at 3 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 2:

Plot:



Best alpha: 0.83

Best tau: 3.91

Minimize with the 1-norm

Diffprev= 381.2112

Steps 0.75 times previous

Alpha=0:0.2:10 starting

Tau=0:0.2:15 starting

500 compare points

Max iterations: 8

Stopped at 4 iterations

dT/dt=-alpha\*Tdel+T-(T^3):

Attempt 3:

Plot:



Best alpha: 0.83

Best tau: 3.91

Minimize with the 2-norm

Diffprev= 21.8439

Steps 0.75 times previous

Alpha=0:0.2:10 starting

Tau=0:0.2:15 starting

500 compare points

Max iterations: 8

Stopped at 4 iterations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1950 Start with 20 year prediction | Inf-Norm Alpha | Inf-Norm Tau | 1-Norm Alpha | 1-Norm Tau | 2-Norm Alpha | 2-Norm Tau |
| Normal | 2.6 | 0.4 | 0.83 | 3.91 | 0.83 | 3.91 |

|  |  |  |  |
| --- | --- | --- | --- |
| 1950 Start with 20 year prediction | Inf-Norm Best Norm (Max difference) | 1-Norm Best Norm (sum of differences) | 2-Norm Best Norm (Root sum squared of differences) |
| Normal | 2.3588 | 381.2112 | 21.8439 |

1950:

dT/dt=-alpha\*tanh(k\*Tdel(1))+beta\*tanh(k\*Tdel(2))+gamma\*cos(2\*pi\*t))

Attempt 1:

Plot:

Best alpha:

Best tau1:

Best beta:

Best tau2:

Minimize with the Inf-norm

Diffprev=

Steps 0.65 times previous

Alpha=0:0.1:5 starting

Tau1=0:0.1:2 starting

Beta=0:0.1:5 starting

Tau2=0:0.1:2 starting

500 compare points

Max iterations: 4

Stopped at \_\_ iterations