

Question_4_Post_Processing

April 2, 2023

```
[1]: import numpy as np;
import matplotlib.pyplot as plt;
import seaborn as sns;
import pandas as pd;
```

```
[2]: Output_file_names = pd.read_csv("Output_file_names.csv",header=None)
Output_file_names
```

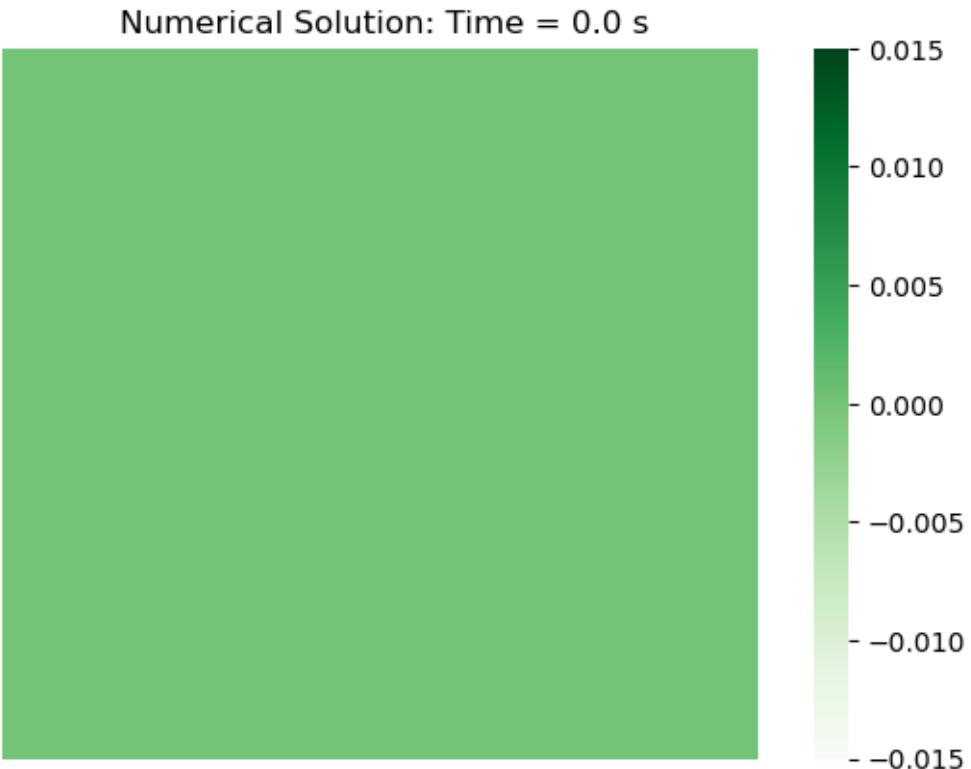
```
[2]:          0
 0    Q_4_Numerical_Solution_at_time_0.000000_.csv
 1    Q_4_Numerical_Solution_at_time_0.005000_.csv
 2    Q_4_Numerical_Solution_at_time_0.010000_.csv
 3    Q_4_Numerical_Solution_at_time_0.015000_.csv
 4    Q_4_Numerical_Solution_at_time_0.020000_.csv
 ..
   ...
196   Q_4_Numerical_Solution_at_time_0.980000_.csv
197   Q_4_Numerical_Solution_at_time_0.985000_.csv
198   Q_4_Numerical_Solution_at_time_0.990000_.csv
199   Q_4_Numerical_Solution_at_time_0.995000_.csv
200   Q_4_Numerical_Solution_at_time_1.000000_.csv
```

[201 rows x 1 columns]

```
[3]: Image = []
t = np.arange(0,1,0.005)
for i,file_name in enumerate(Output_file_names.to_numpy().astype("str")):
    print(file_name[0])
    Numerical = pd.read_csv(file_name[0],header=None).to_numpy()
    hm = sns.heatmap(Numerical,cmap='Greens',vmin=-0.015,vmax=0.015)
    # hm = sns.heatmap(Numerical,cmap='Greens')
    x_ticks = np.linspace(0,1,10)
    y_ticks = np.linspace(0,1,10)
    plt.xticks([],[])
    plt.yticks([],[])
    plt.title(f"Numerical Solution: Time = {t[i]} s")
    plt.show()
    # hm.savefig(f"Time_{i}.png")
```

```
figure = hm.get_figure()
figure.savefig(f'Time_{t[i]}.png', dpi=400)
Image.append(f'Time_{t[i]}.png')
```

Q_4_Numerical_Solution_at_time_0.000000_.csv



Q_4_Numerical_Solution_at_time_0.005000_.csv

Numerical Solution: Time = 0.005 s



Q_4_Numerical_Solution_at_time_0.010000_.csv

Numerical Solution: Time = 0.01 s



Q_4_Numerical_Solution_at_time_0.015000_.csv

Numerical Solution: Time = 0.015 s



Q_4_Numerical_Solution_at_time_0.020000_.csv

Numerical Solution: Time = 0.02 s



Q_4_Numerical_Solution_at_time_0.025000_.csv

Numerical Solution: Time = 0.025 s



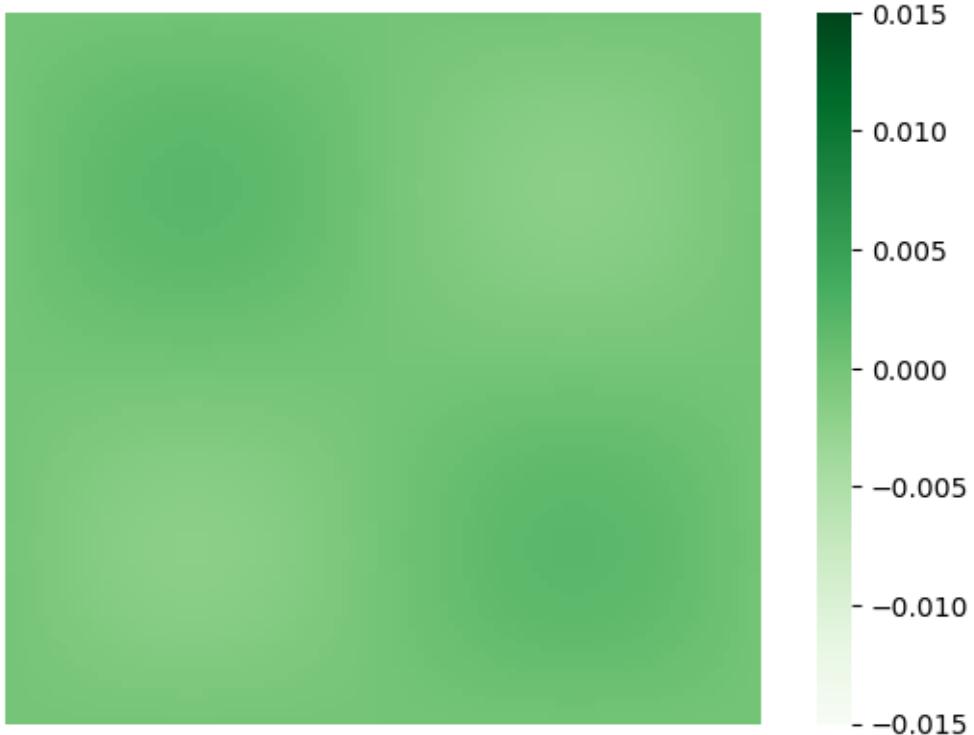
Q_4_Numerical_Solution_at_time_0.030000_.csv

Numerical Solution: Time = 0.03 s



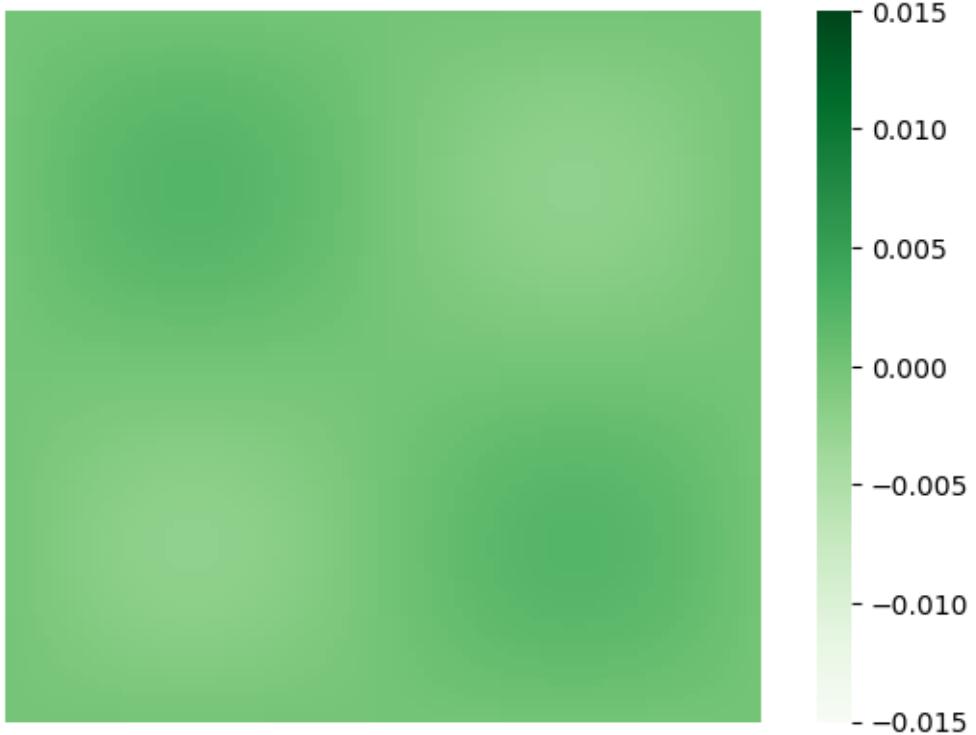
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Numerical Solution: Time = 0.035 s



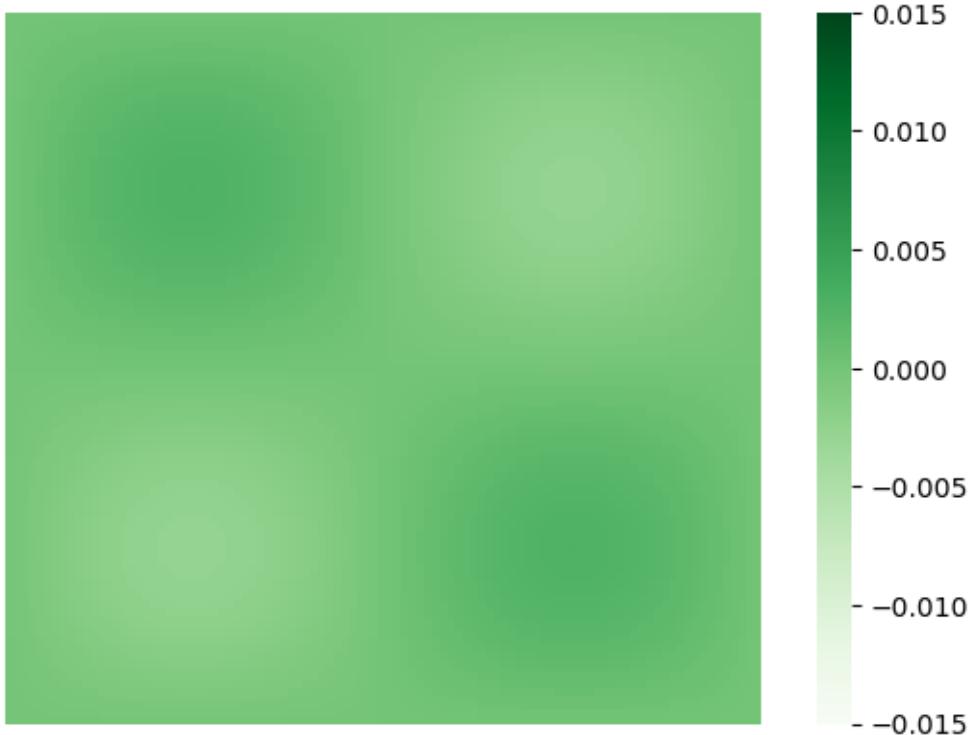
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Numerical Solution: Time = 0.04 s



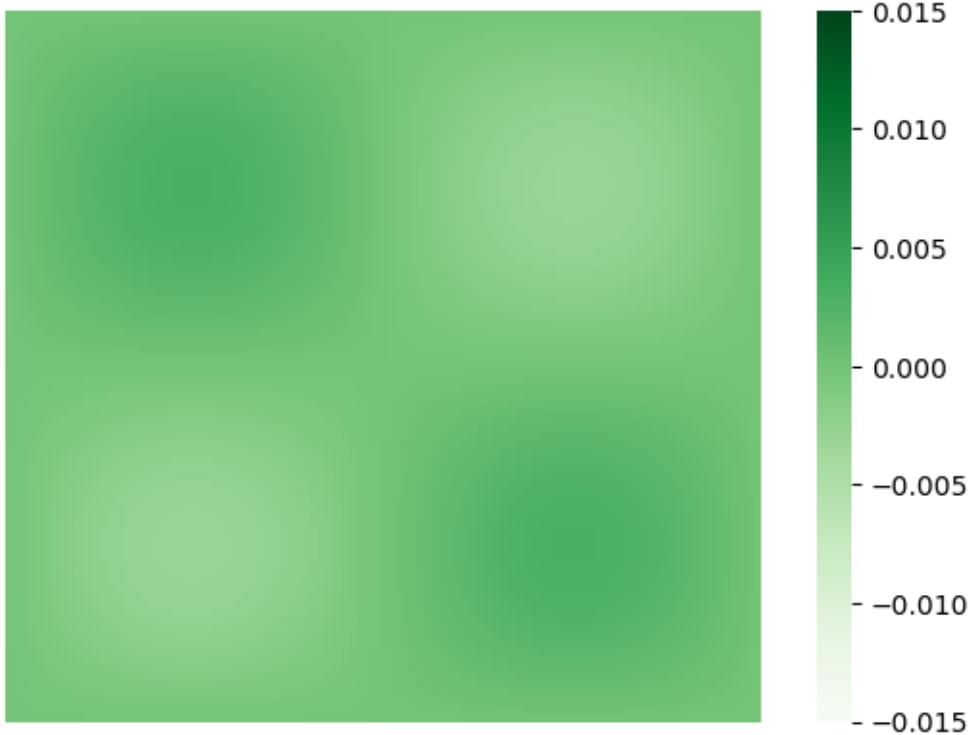
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Numerical Solution: Time = 0.045 s



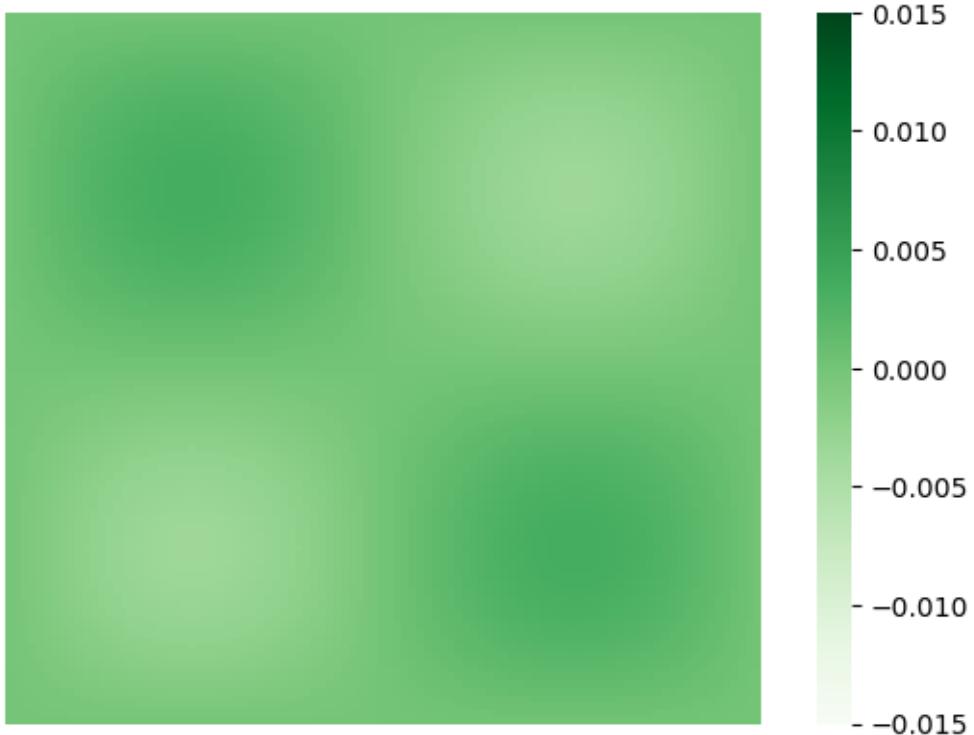
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Numerical Solution: Time = 0.05 s



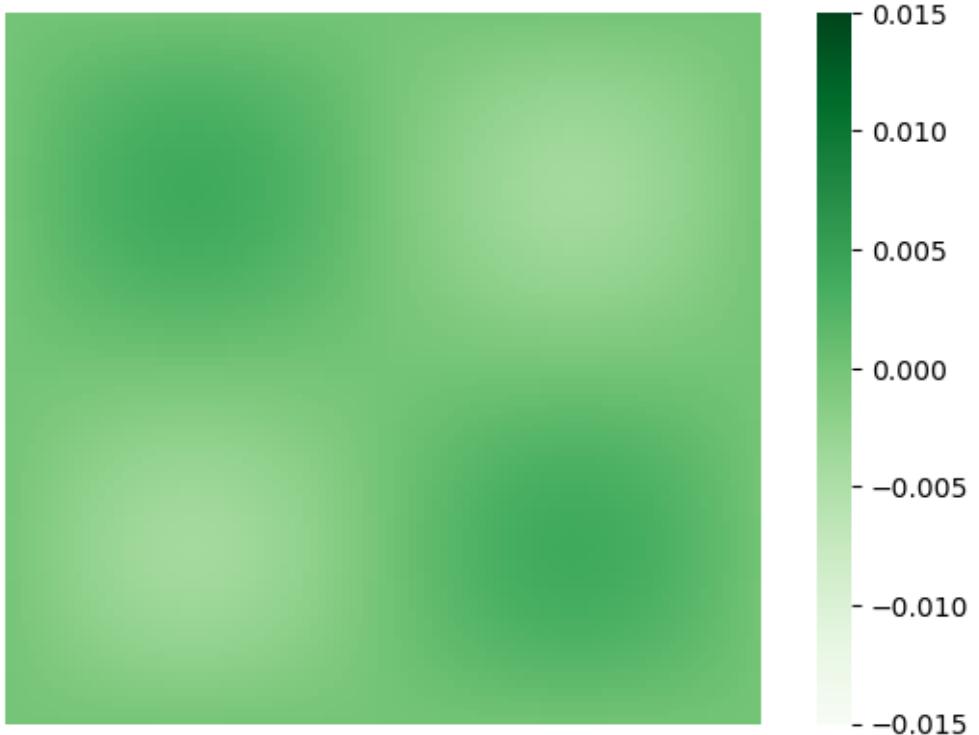
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Numerical Solution: Time = 0.055 s



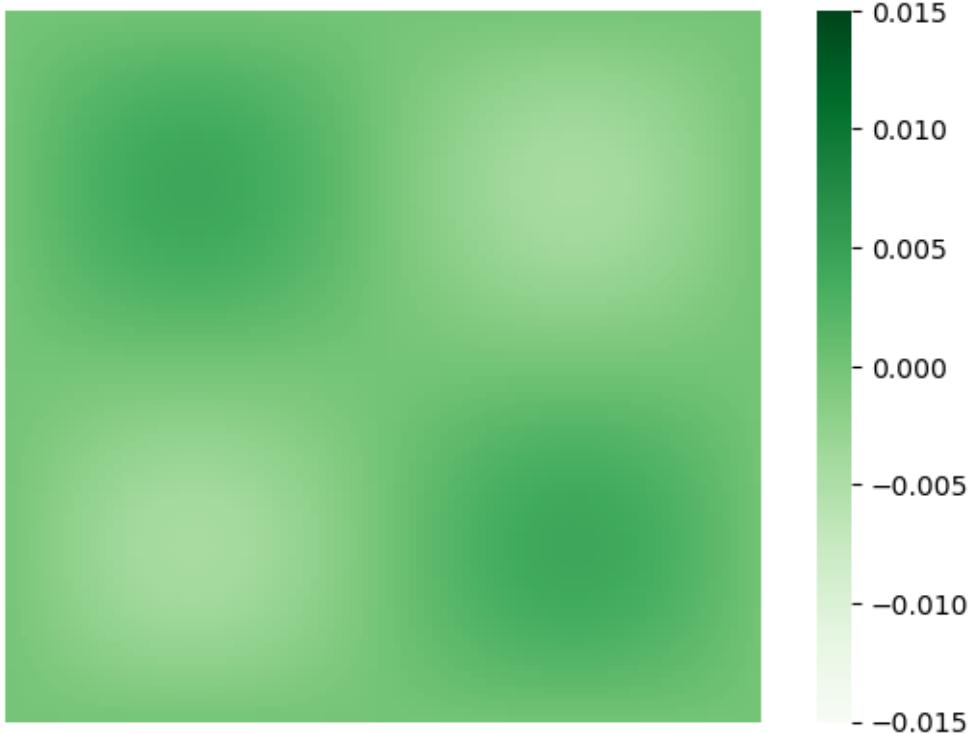
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Numerical Solution: Time = 0.06 s



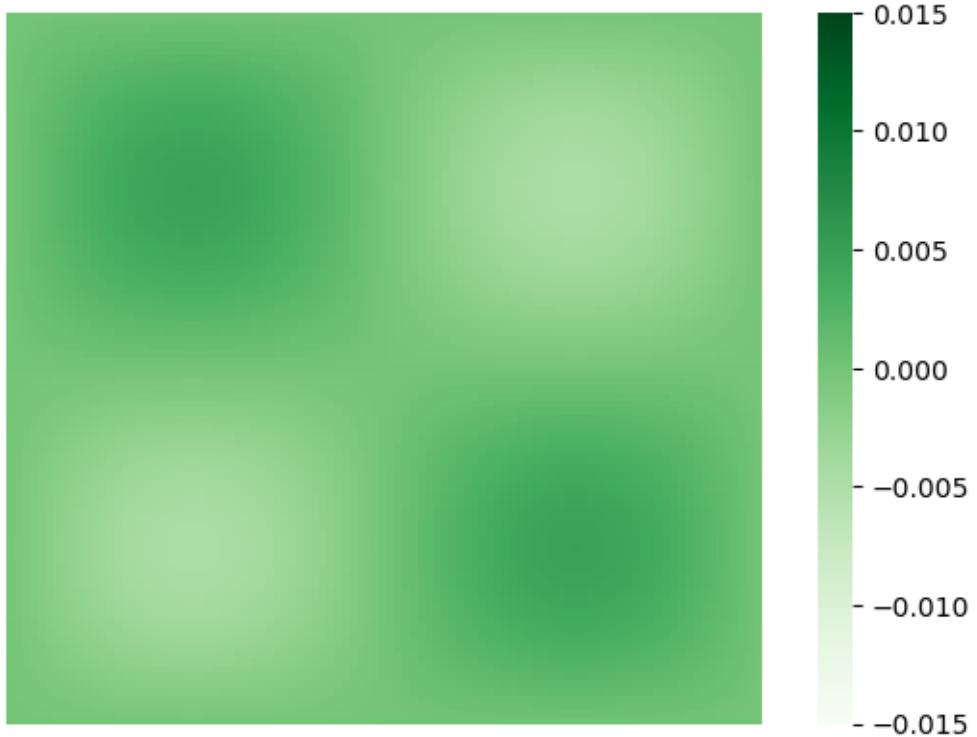
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Numerical Solution: Time = 0.065 s



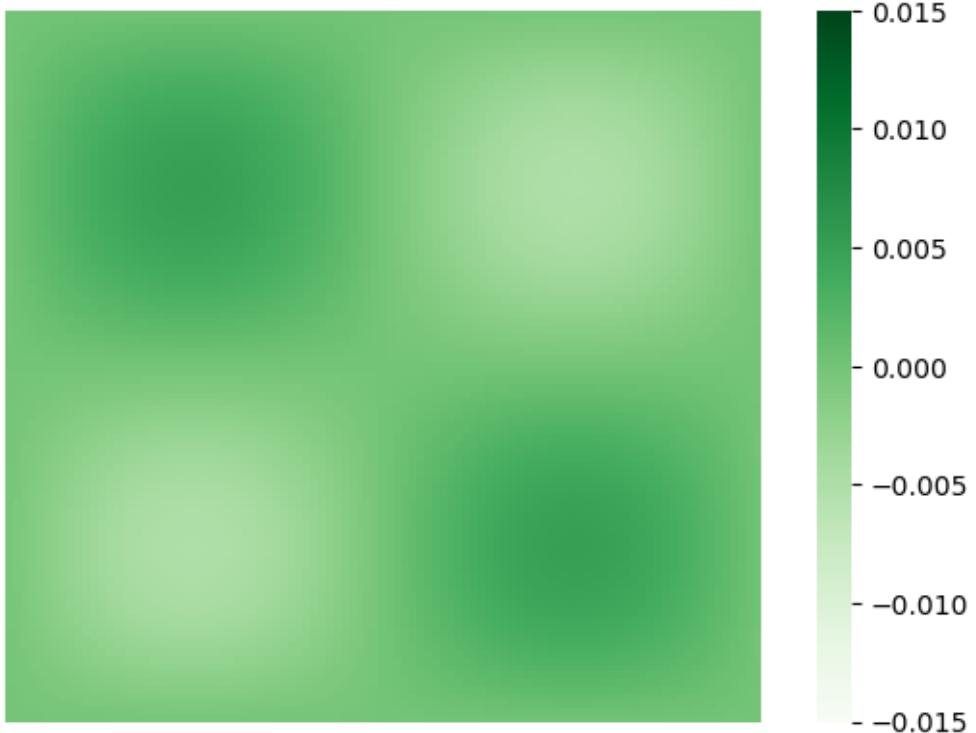
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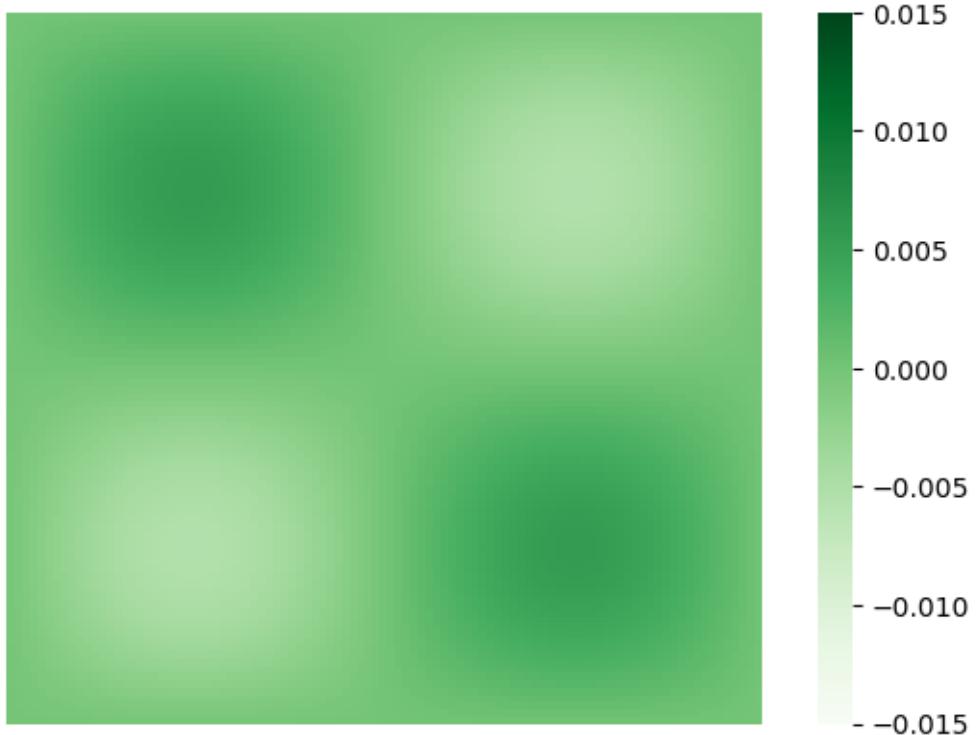
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Numerical Solution: Time = 0.075 s



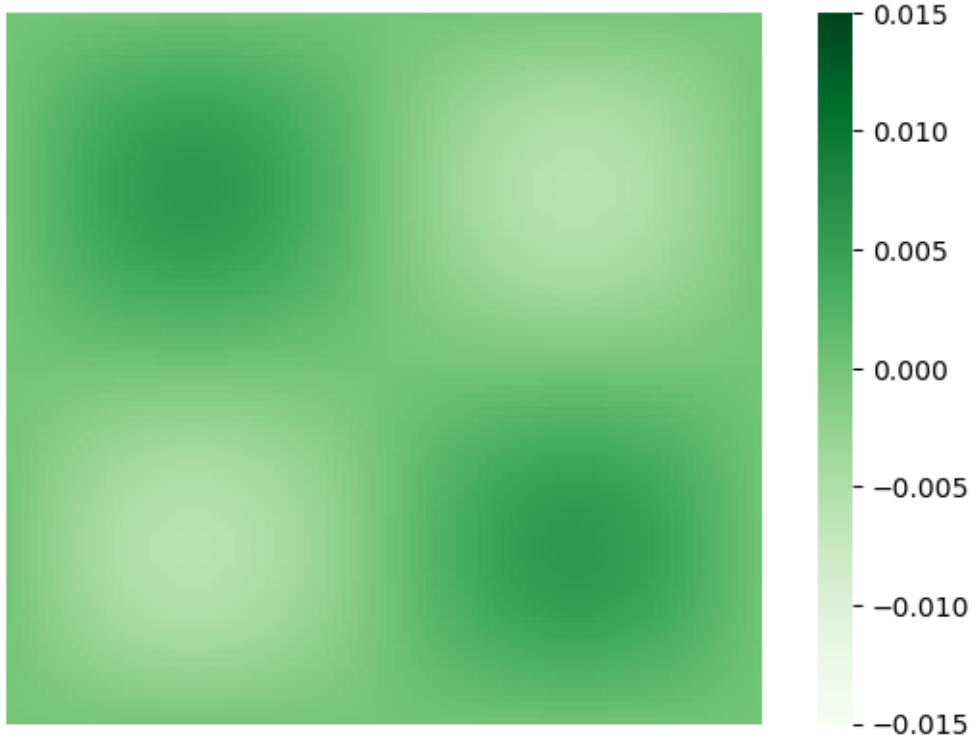
Q_4_Numerical_Solution_at_time_0.080000_.csv

Numerical Solution: Time = 0.08 s



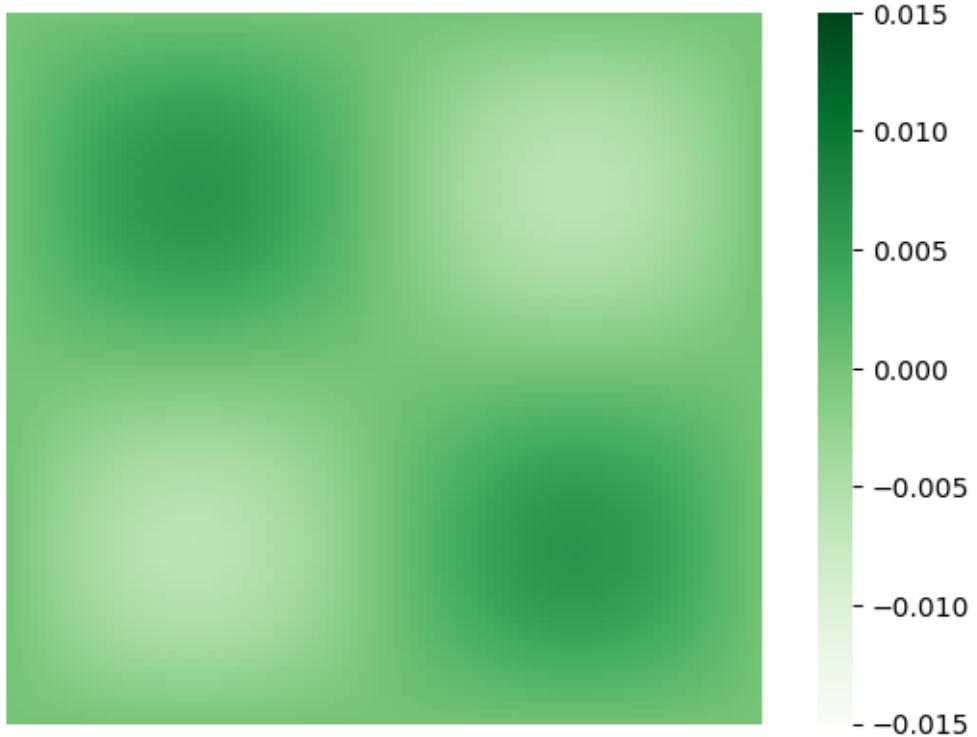
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Numerical Solution: Time = 0.085 s



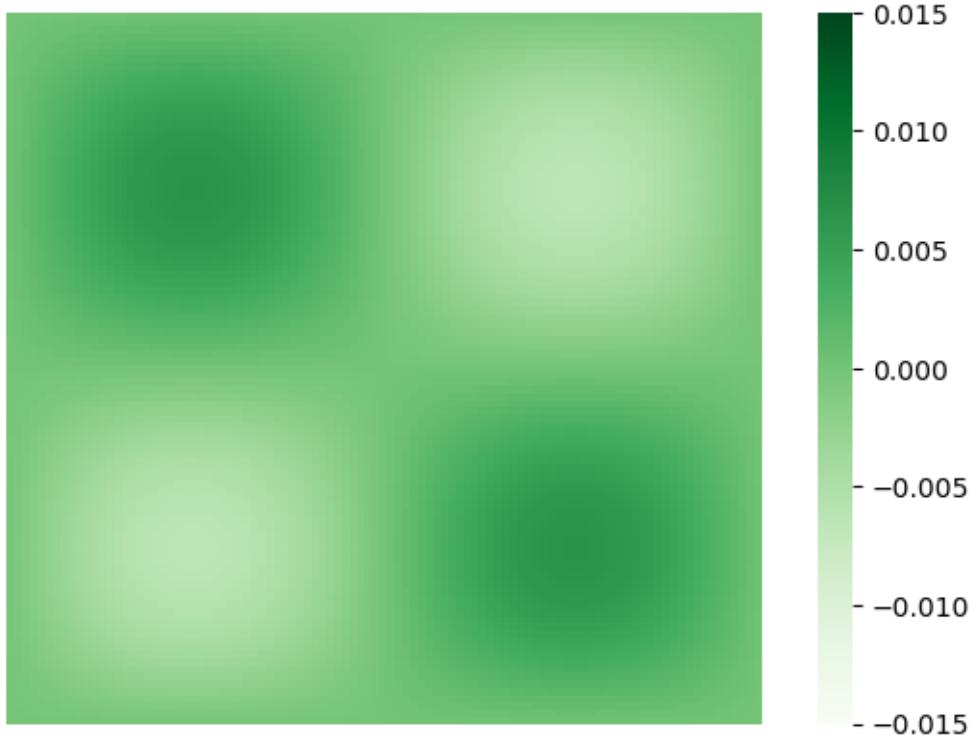
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Numerical Solution: Time = 0.09 s



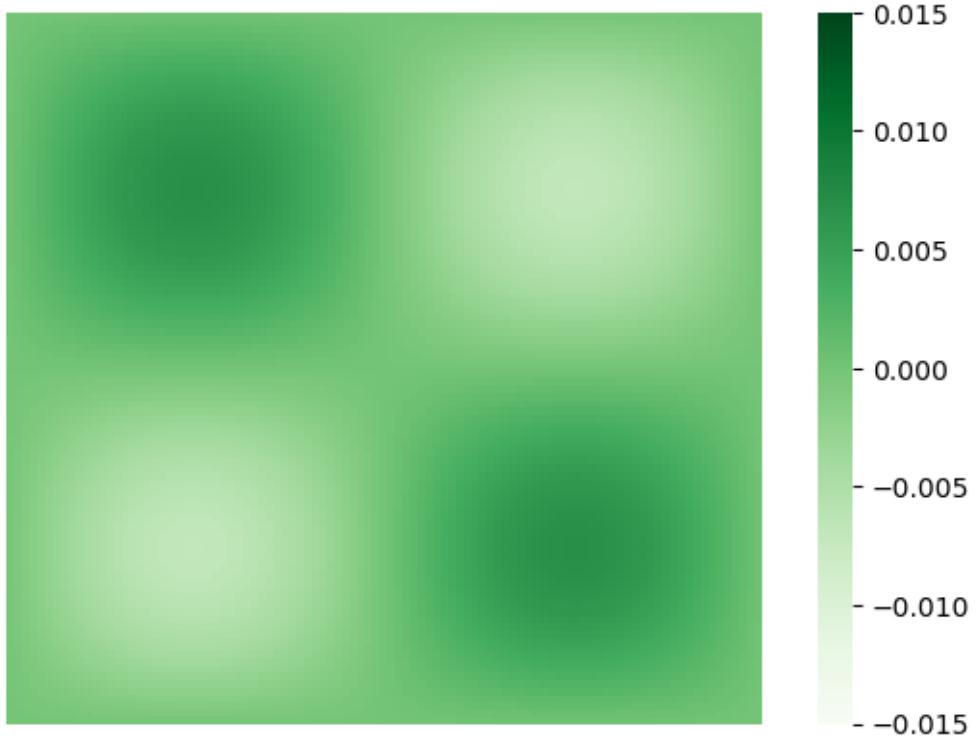
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Numerical Solution: Time = 0.095 s



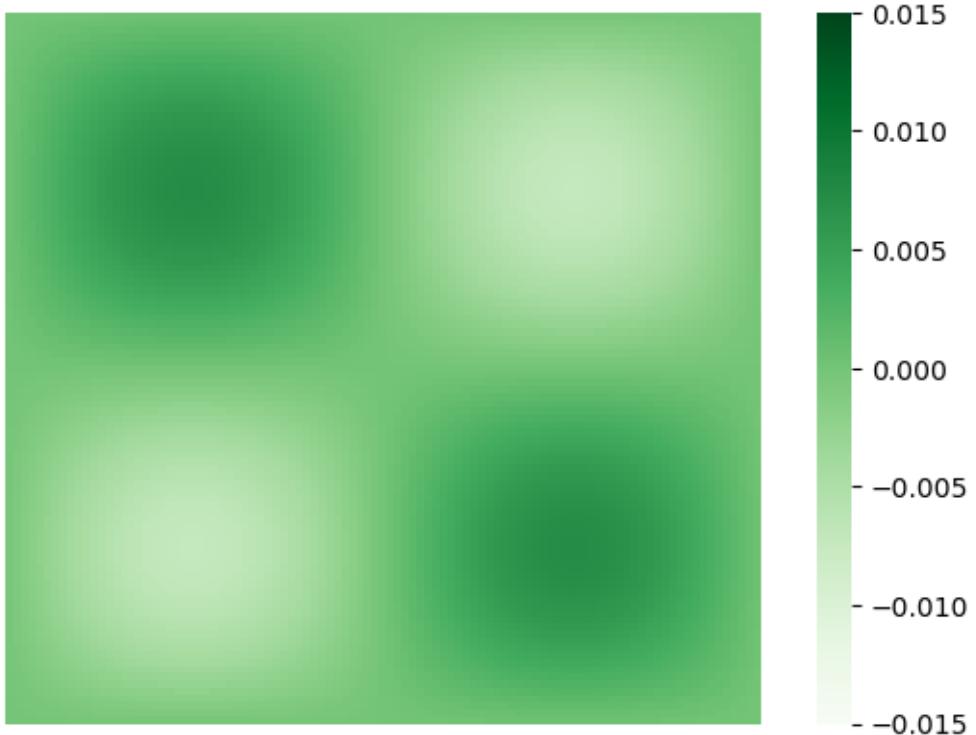
Q_4_Numerical_Solution_at_time_0.100000_.csv

Numerical Solution: Time = 0.1 s



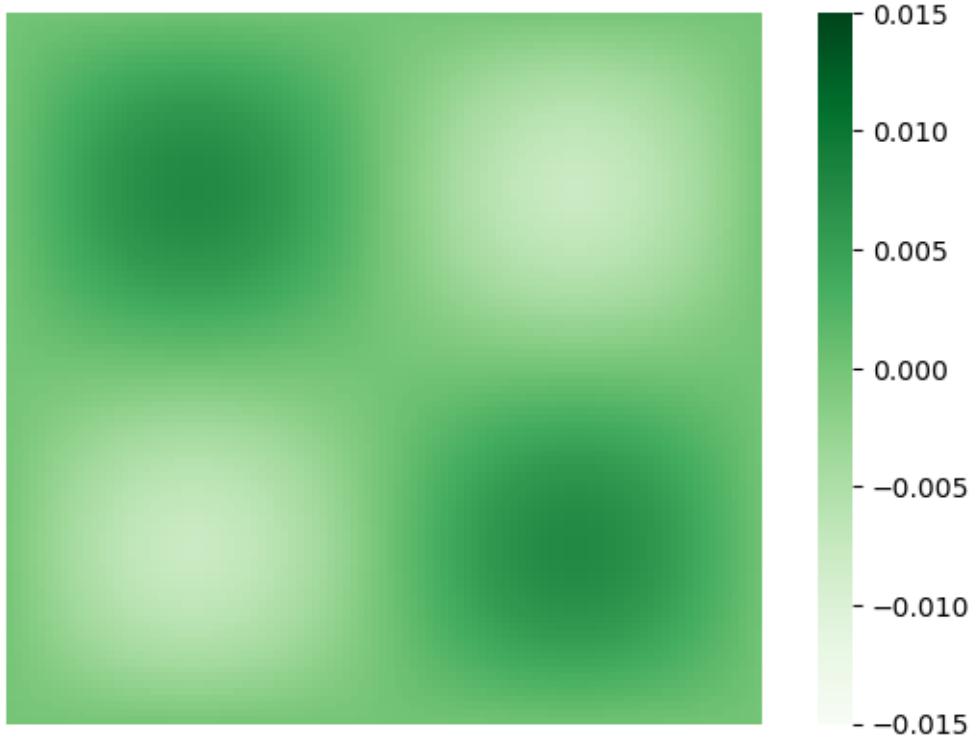
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Numerical Solution: Time = 0.105 s



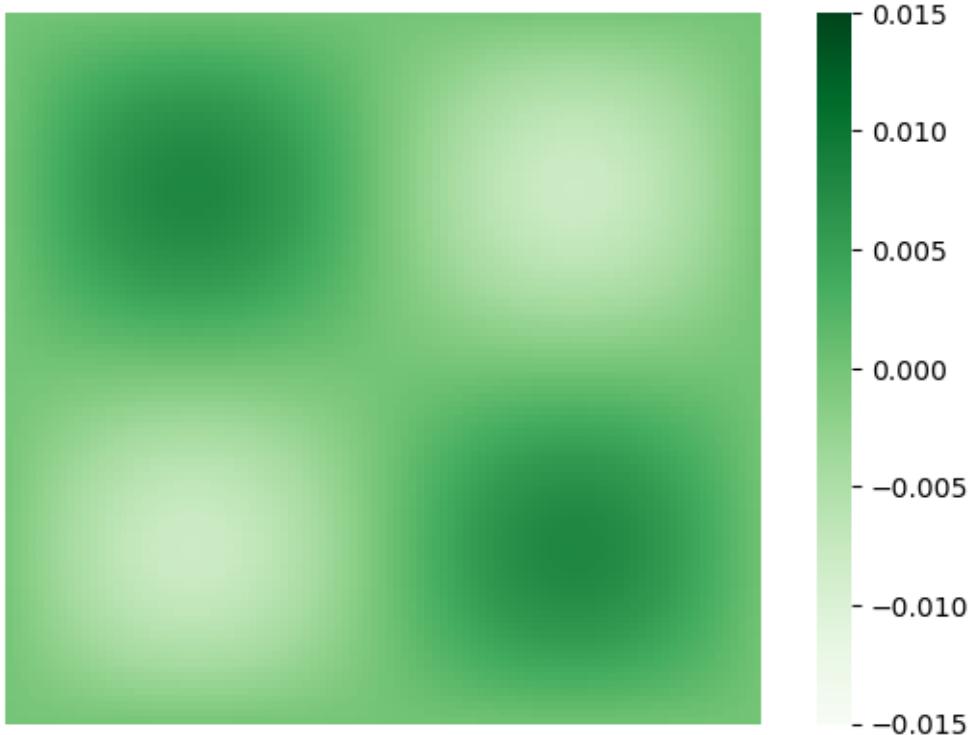
Q_4_Numerical_Solution_at_time_0.110000_.csv

Numerical Solution: Time = 0.11 s



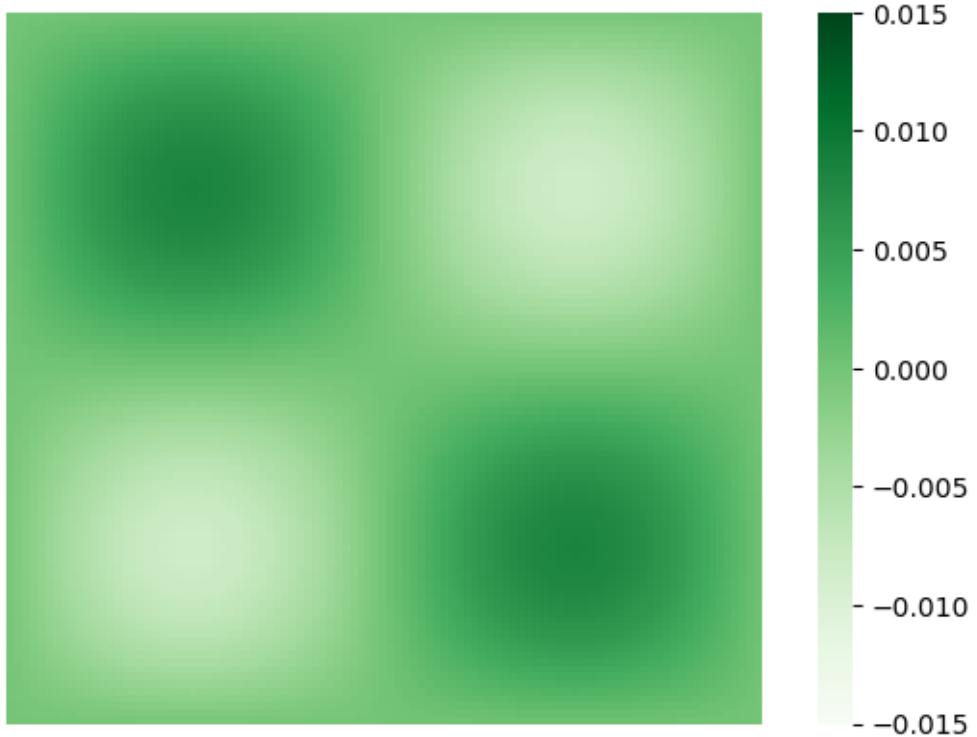
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Numerical Solution: Time = 0.115 s



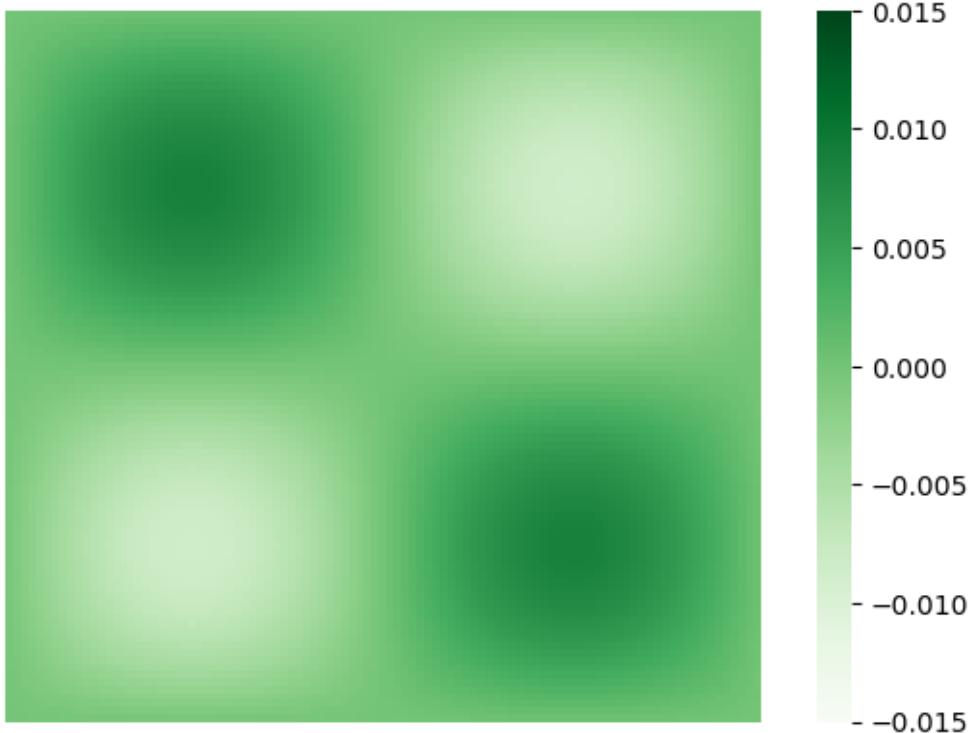
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Numerical Solution: Time = 0.12 s



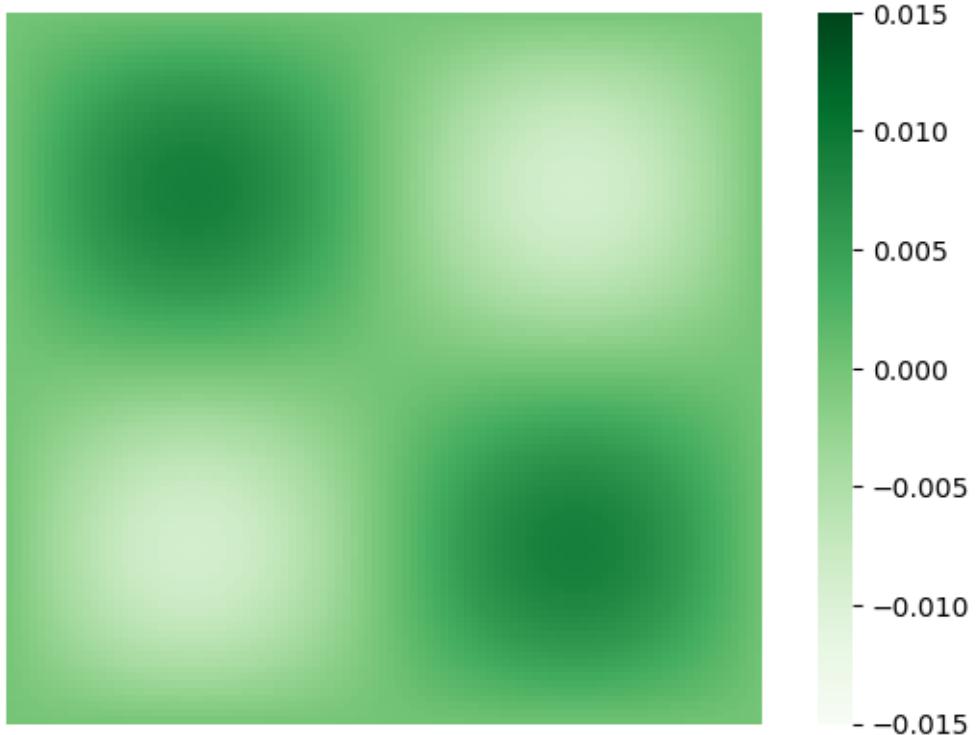
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Numerical Solution: Time = 0.125 s



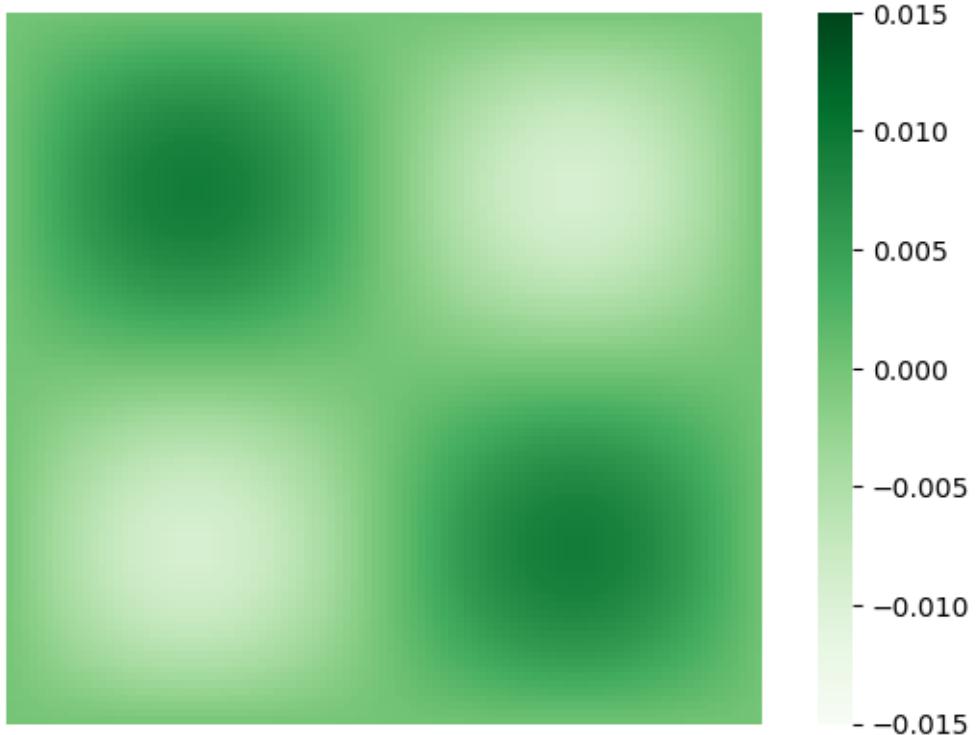
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Numerical Solution: Time = 0.13 s



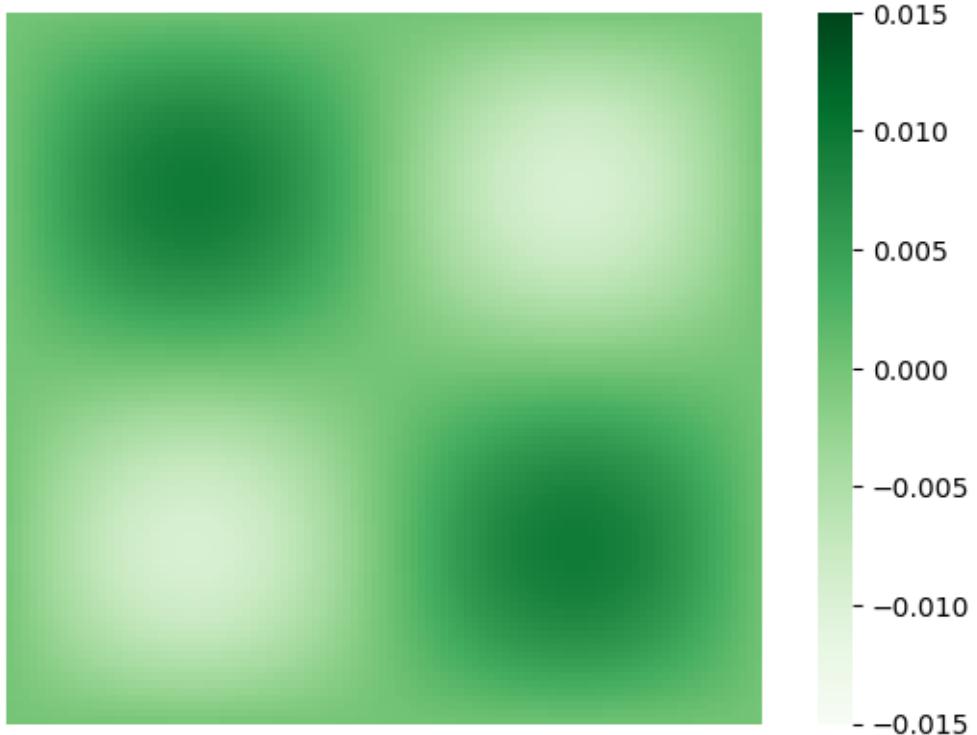
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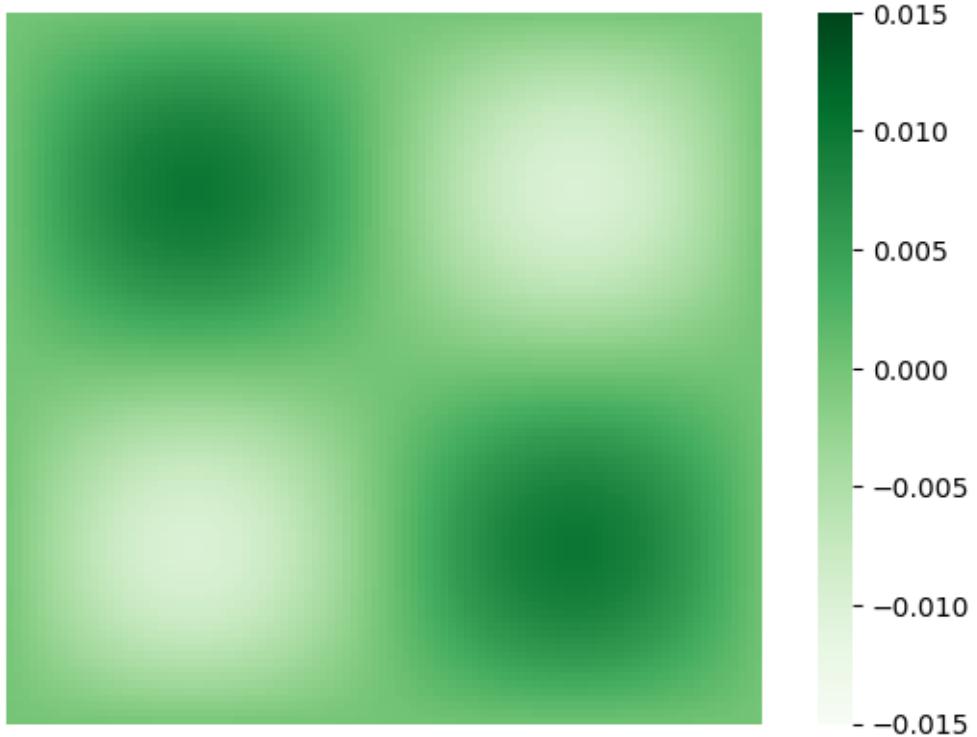
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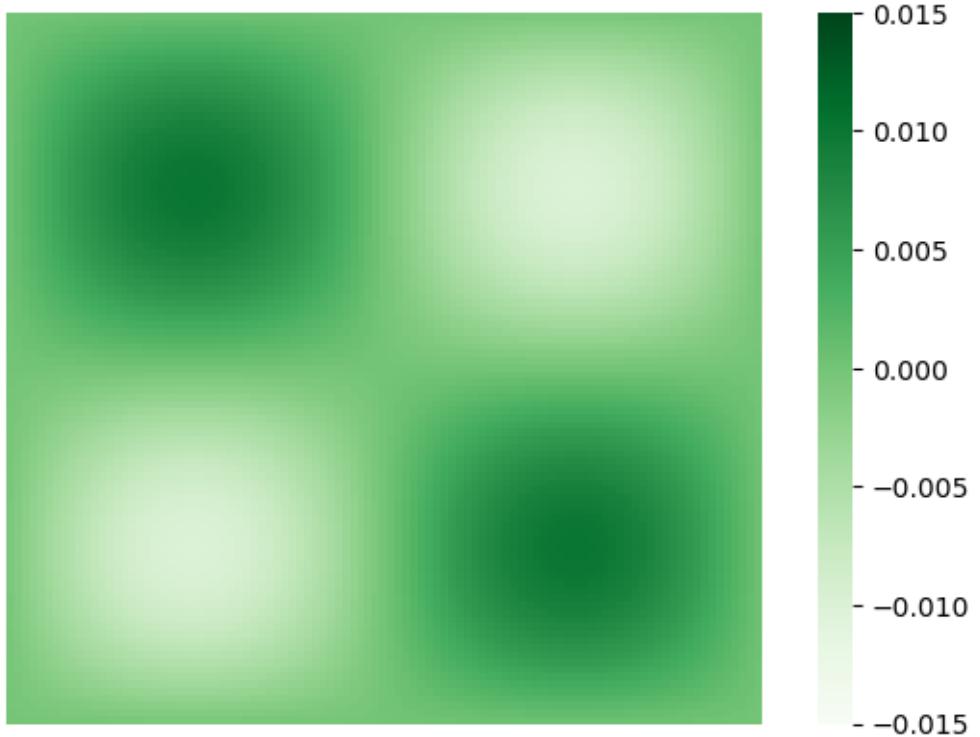
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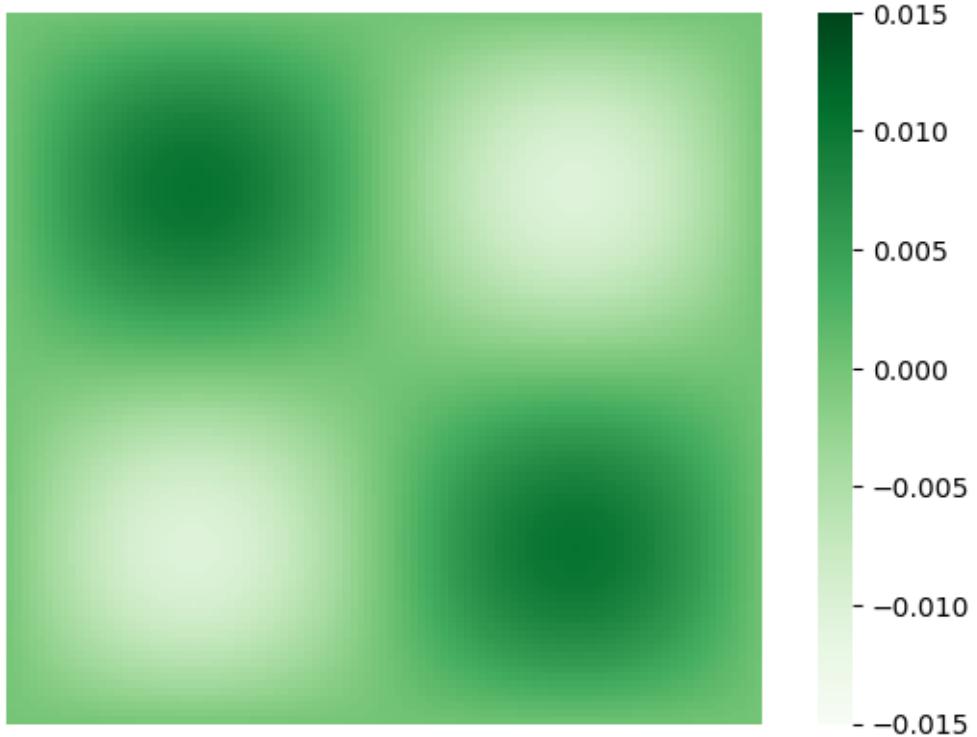
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Numerical Solution: Time = 0.15 s



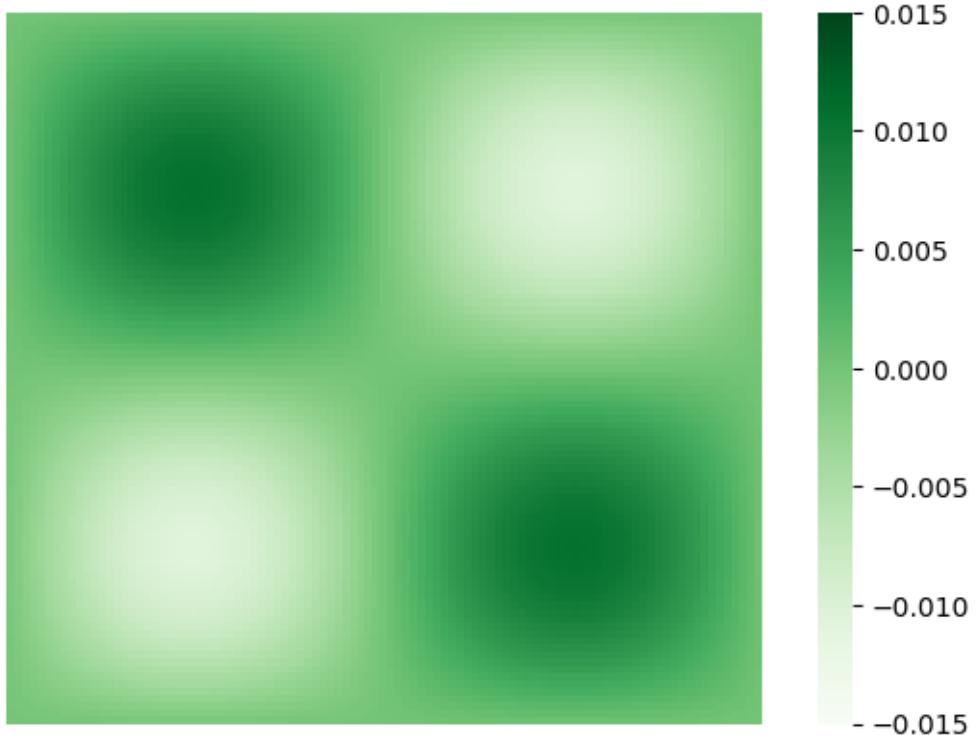
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Numerical Solution: Time = 0.155 s



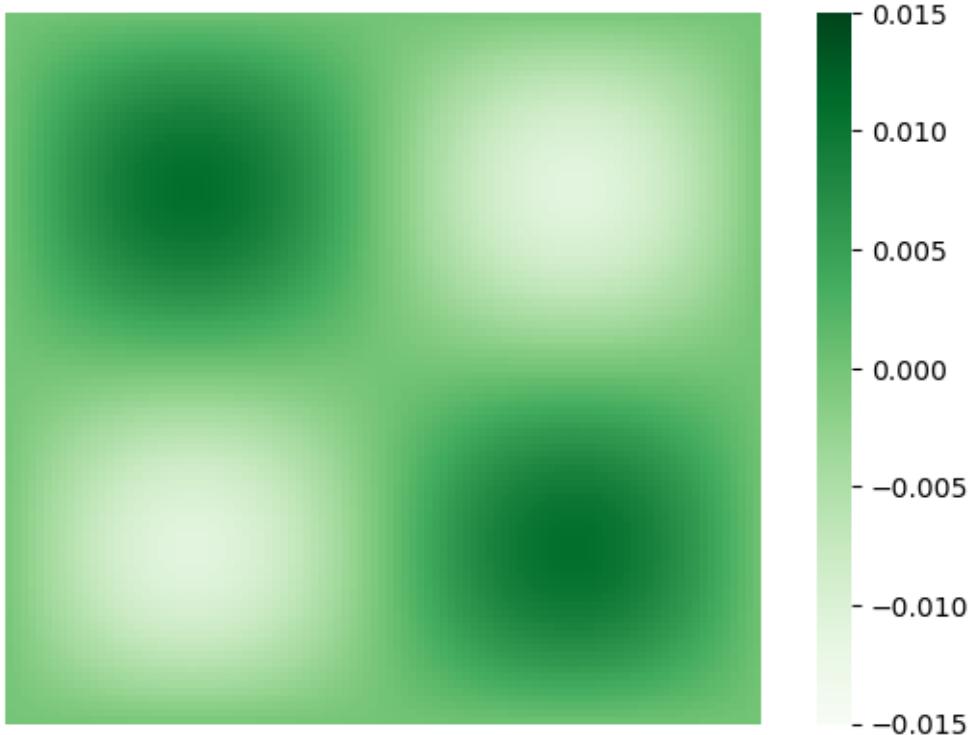
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Numerical Solution: Time = 0.16 s



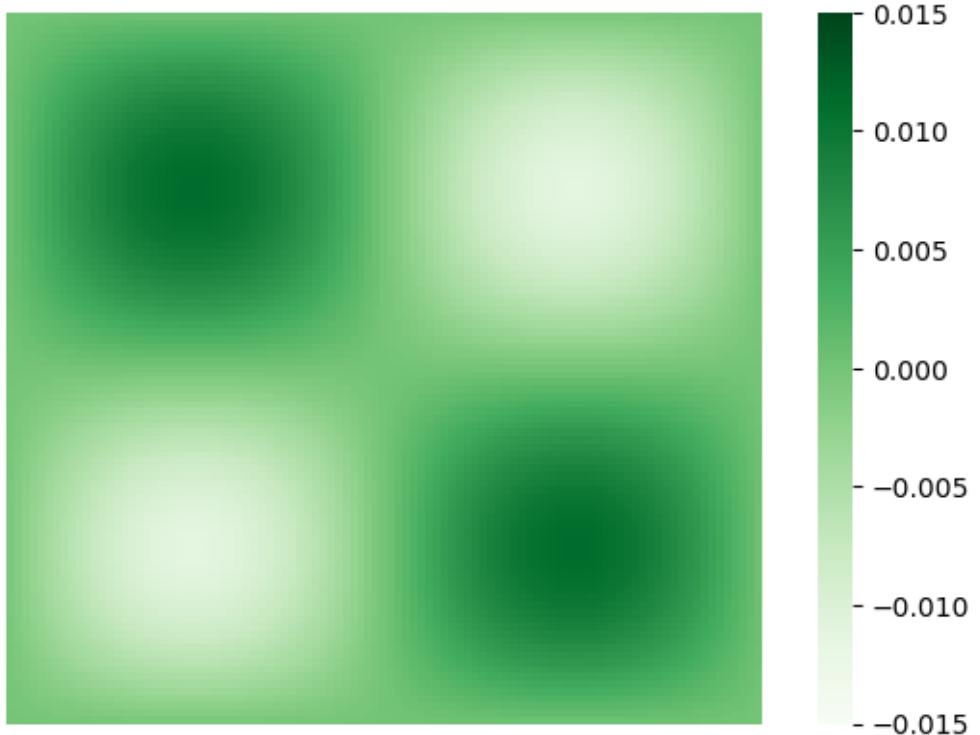
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Numerical Solution: Time = 0.165 s



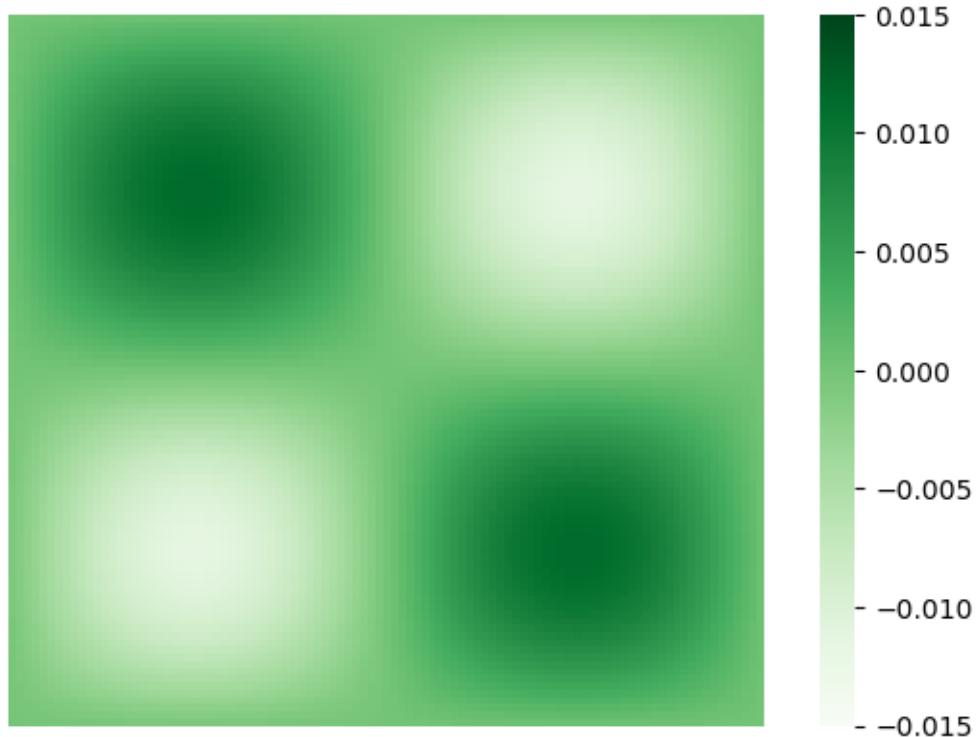
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Numerical Solution: Time = 0.17 s



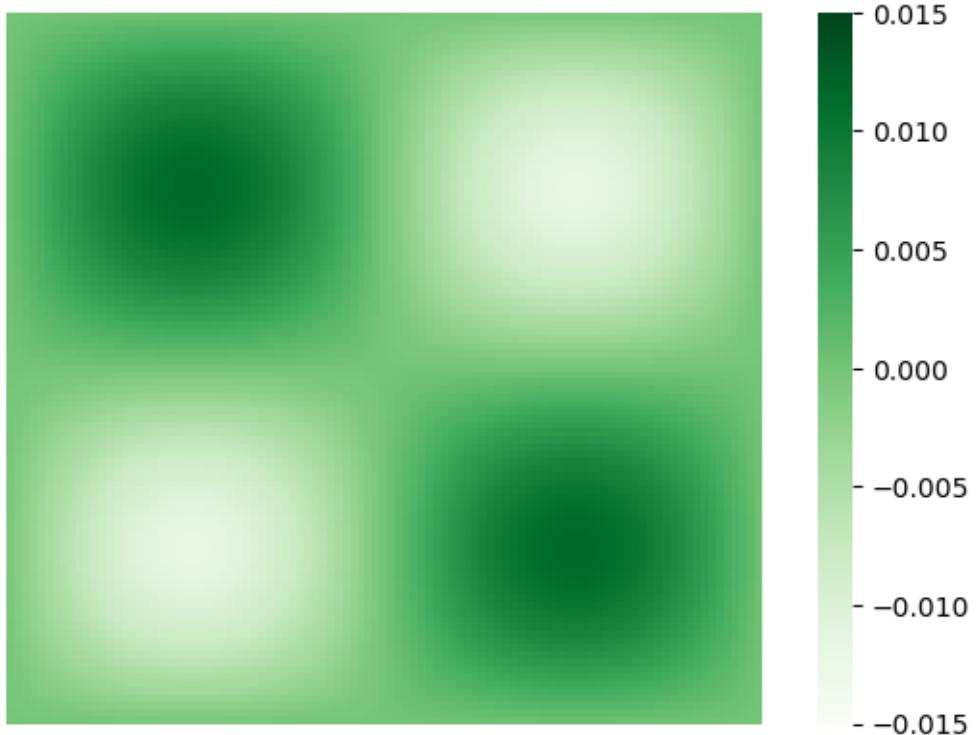
Q_4_Numerical_Solution_at_time_0.175000_.csv

Numerical Solution: Time = 0.17500000000000002 s



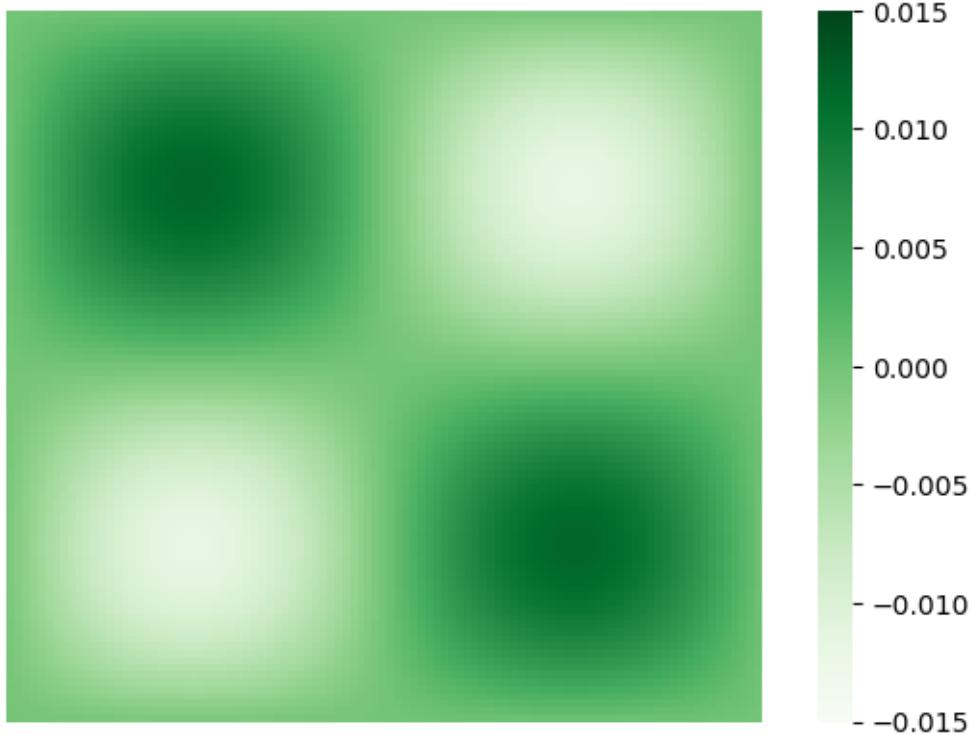
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Numerical Solution: Time = 0.18 s



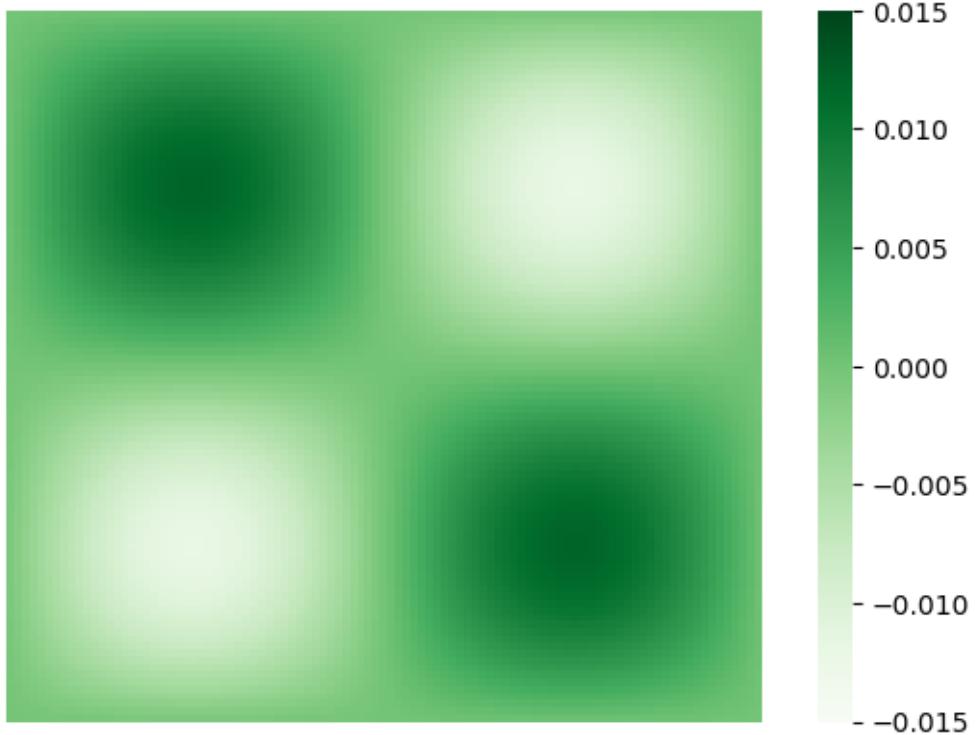
Q_4_Numerical_Solution_at_time_0.185000_.csv

Numerical Solution: Time = 0.185 s



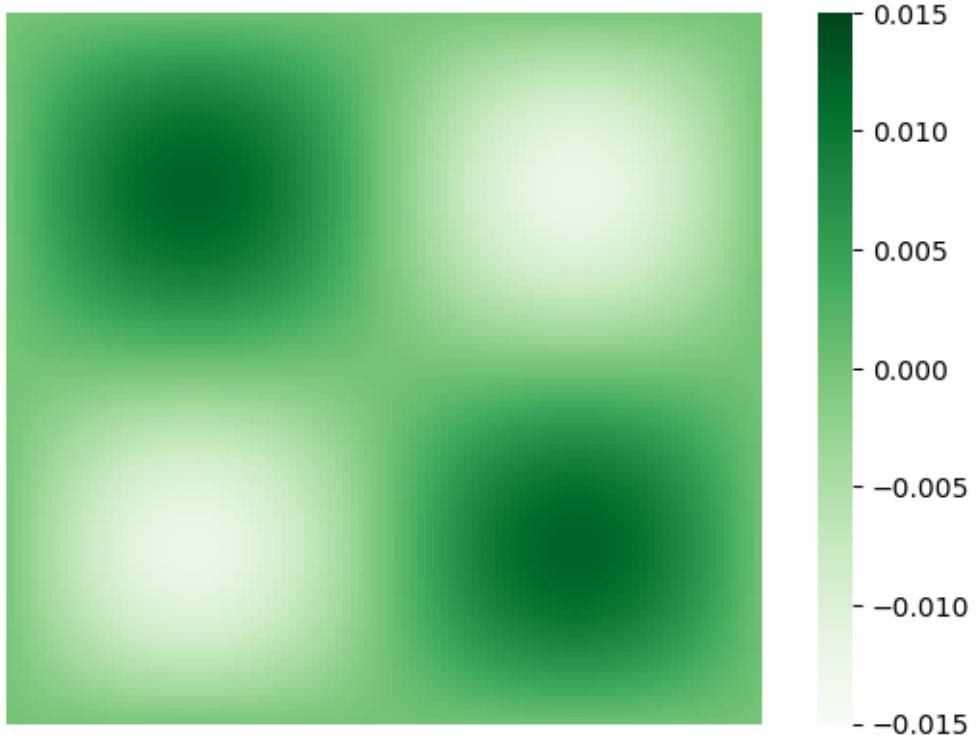
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Numerical Solution: Time = 0.19 s



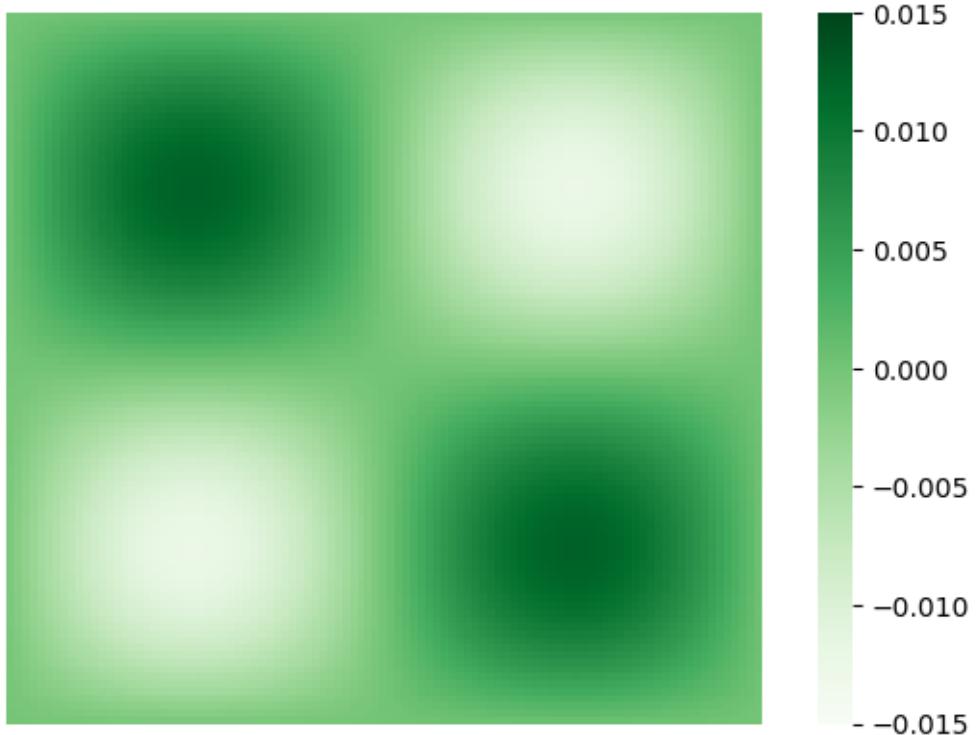
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Numerical Solution: Time = 0.195 s



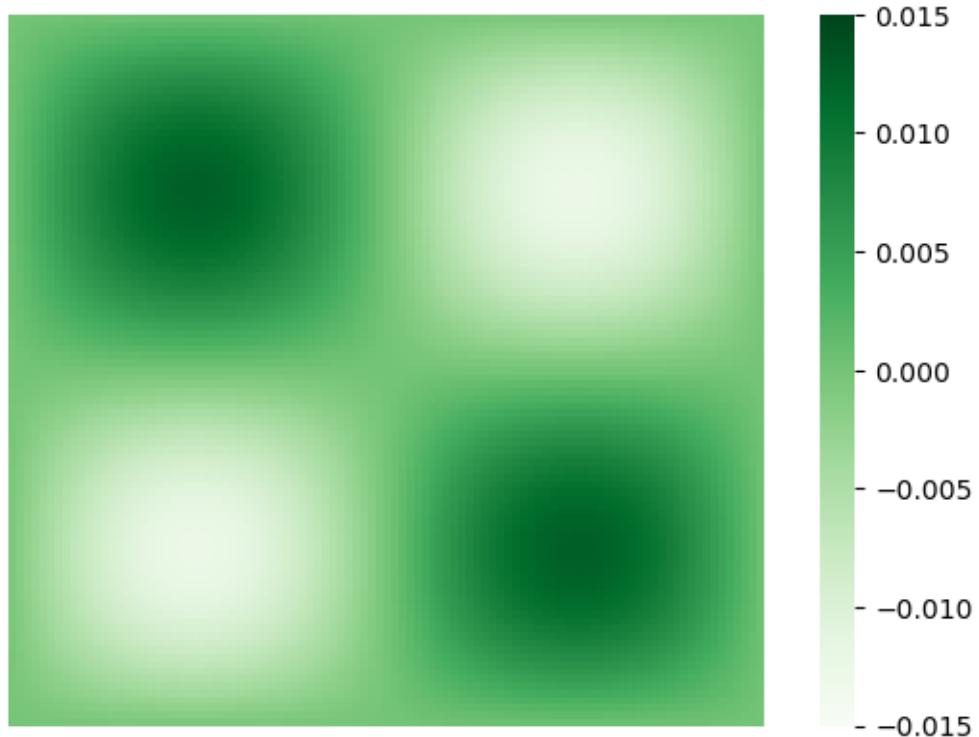
Q_4_Numerical_Solution_at_time_0.200000_.csv

Numerical Solution: Time = 0.2 s



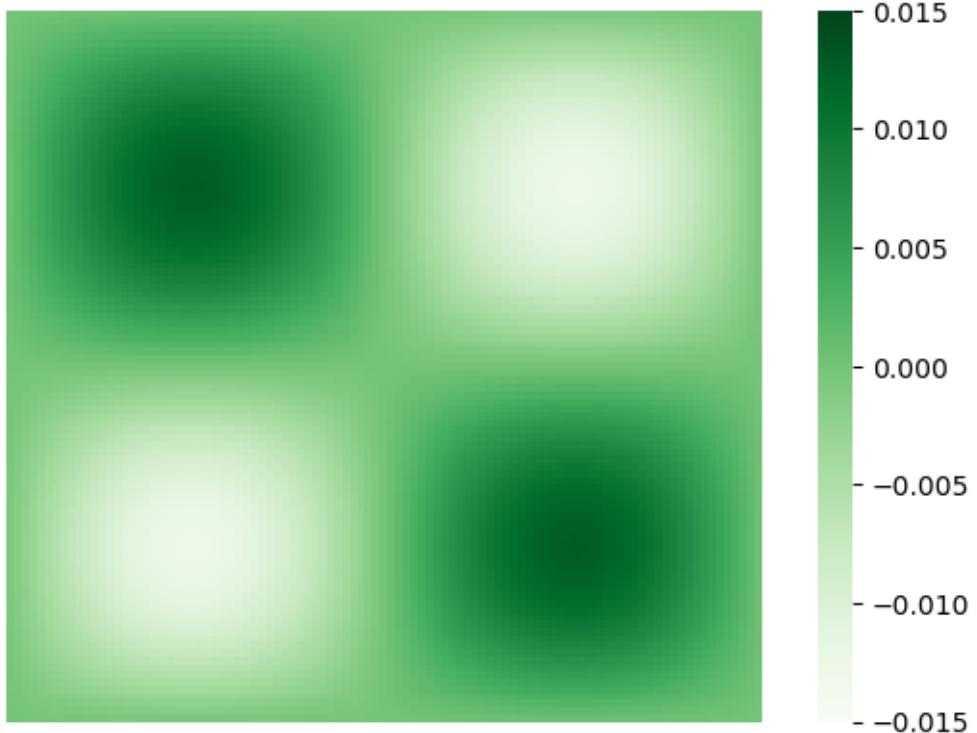
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Numerical Solution: Time = 0.20500000000000002 s



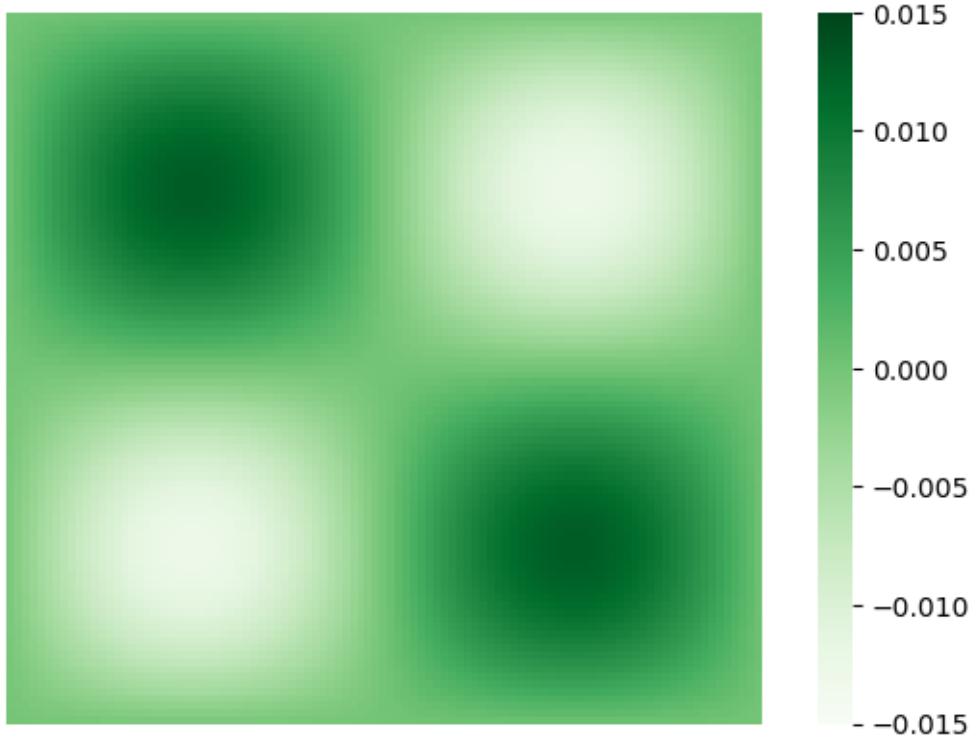
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Numerical Solution: Time = 0.21 s



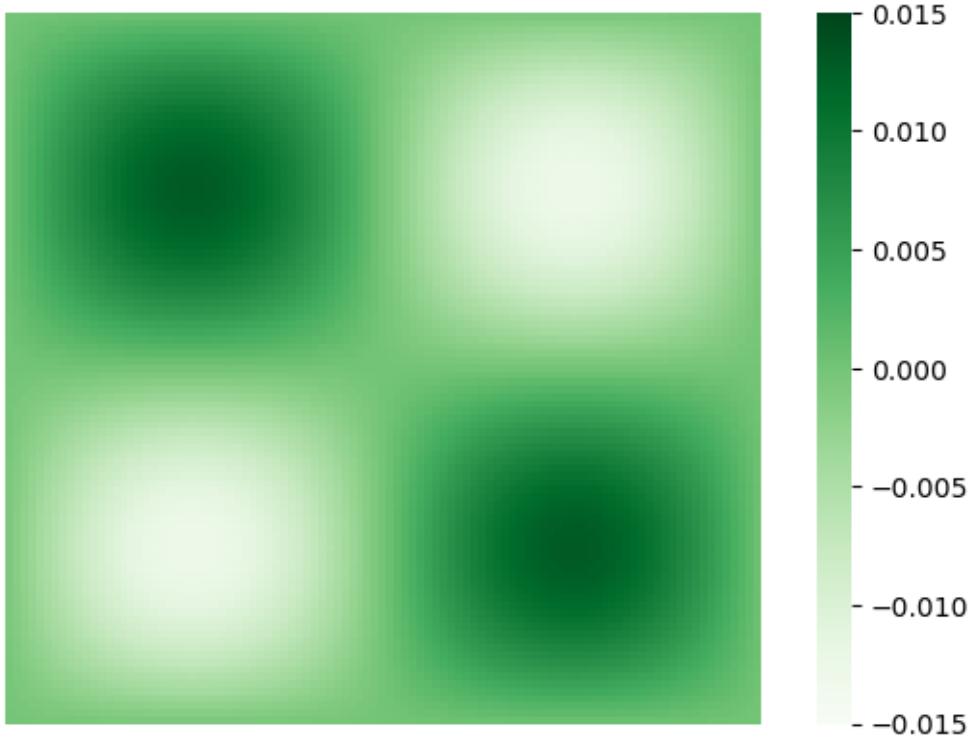
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Numerical Solution: Time = 0.215 s



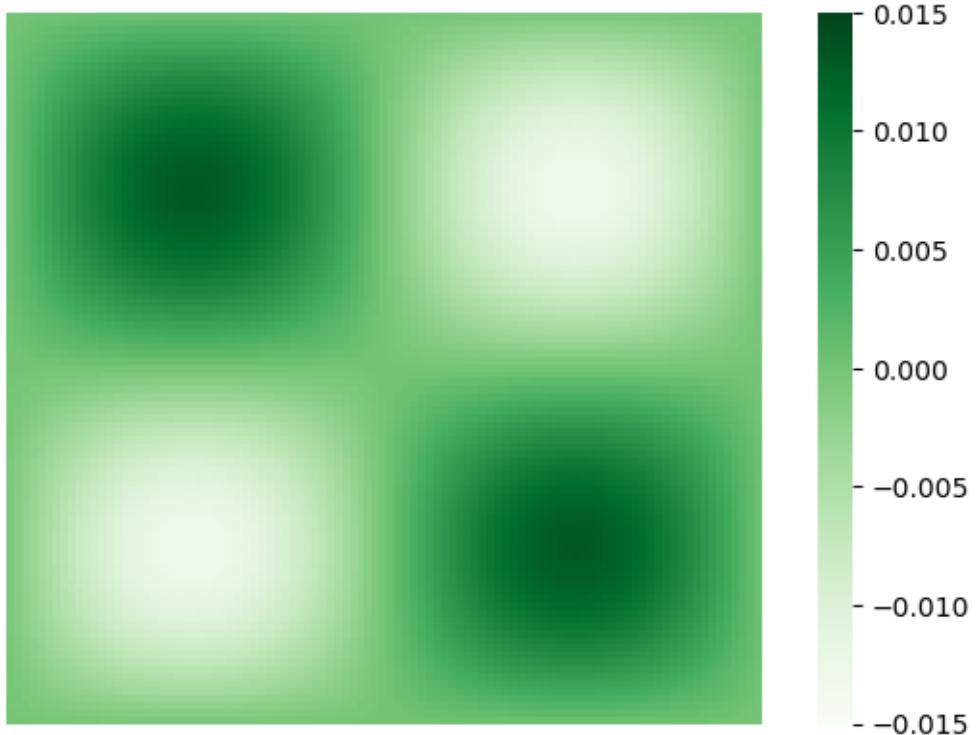
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Numerical Solution: Time = 0.22 s



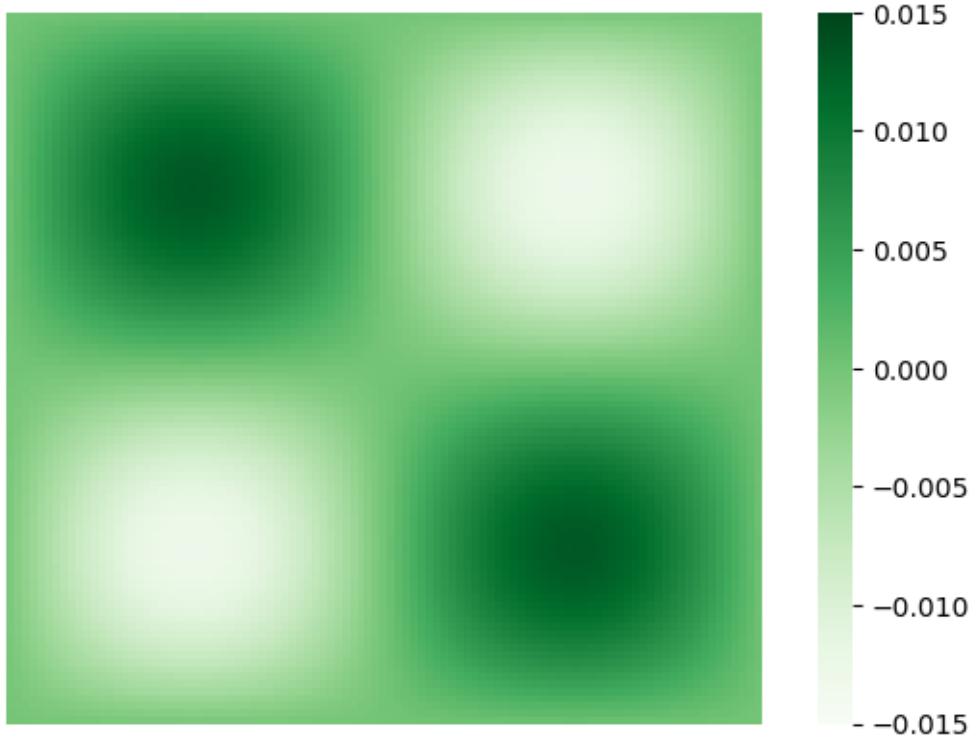
Q_4_Numerical_Solution_at_time_0.225000_.csv

Numerical Solution: Time = 0.225 s



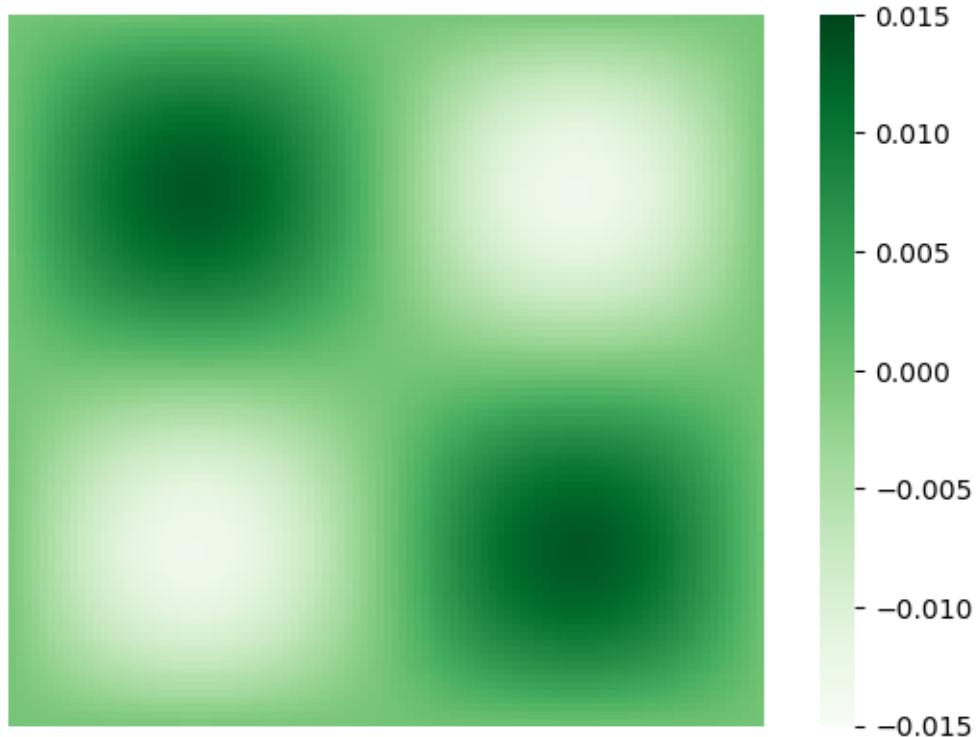
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Numerical Solution: Time = 0.23 s



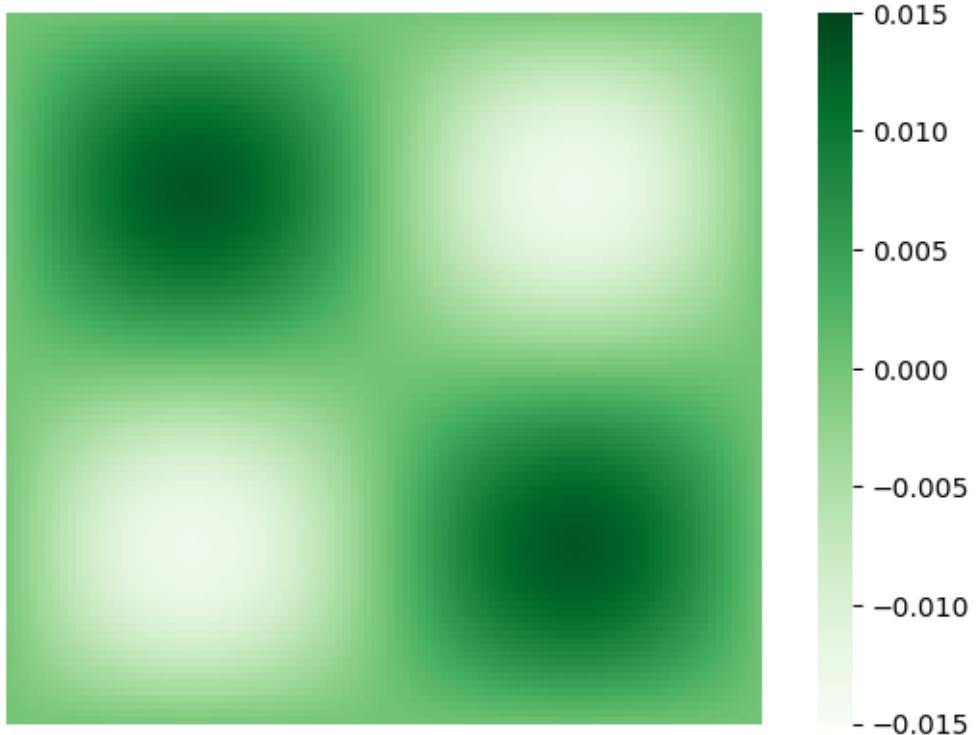
Q_4_Numerical_Solution_at_time_0.235000_.csv

Numerical Solution: Time = 0.23500000000000001 s



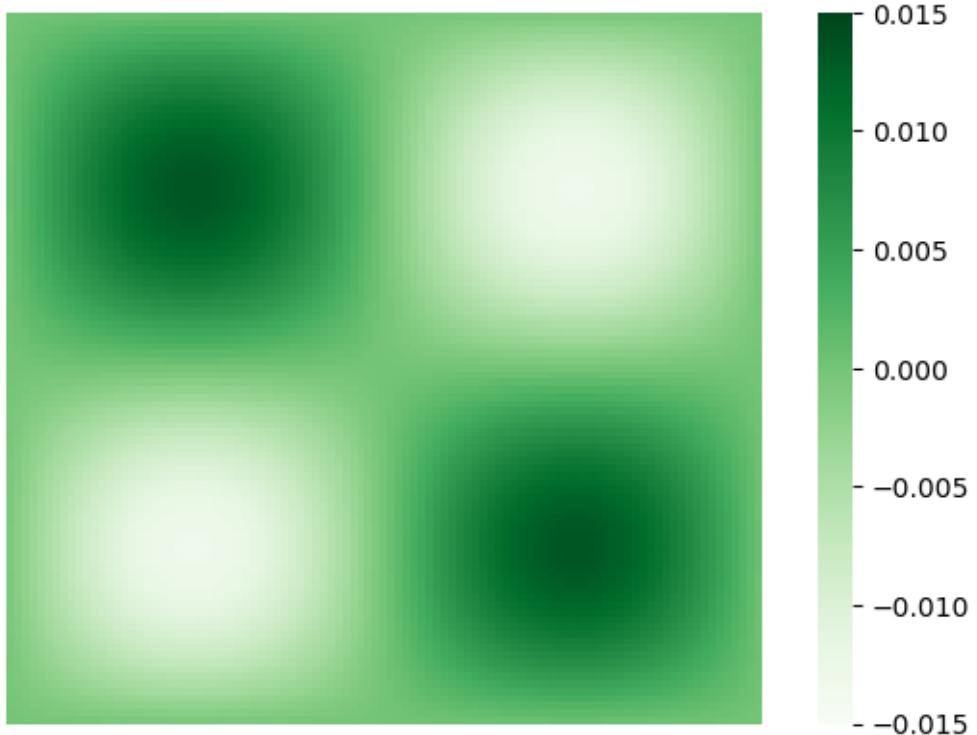
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Numerical Solution: Time = 0.24 s



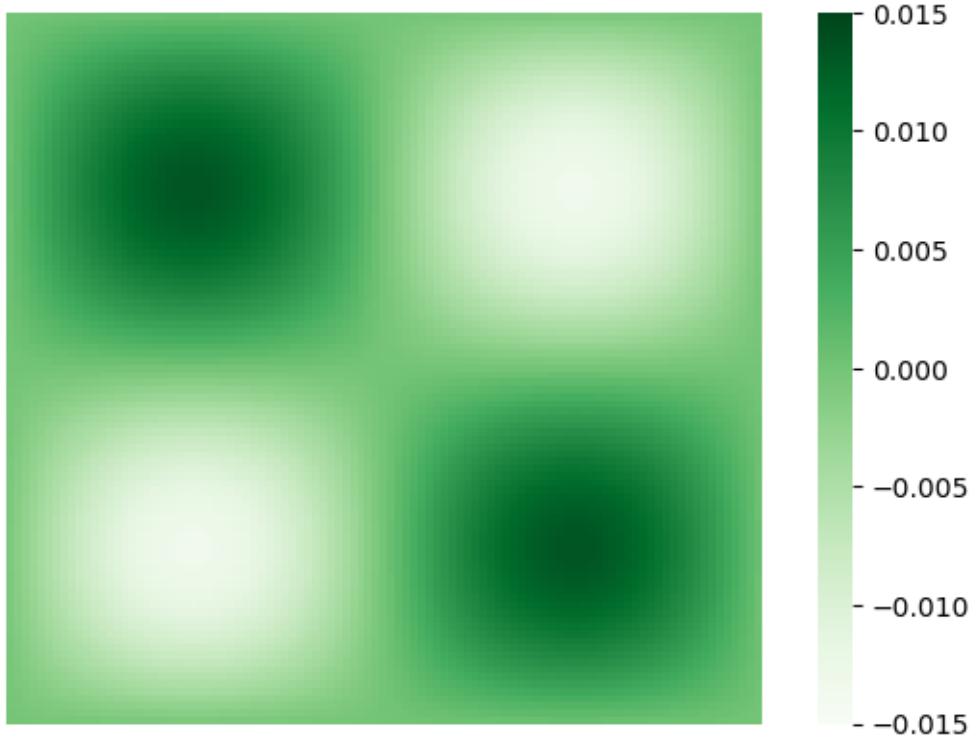
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Numerical Solution: Time = 0.245 s



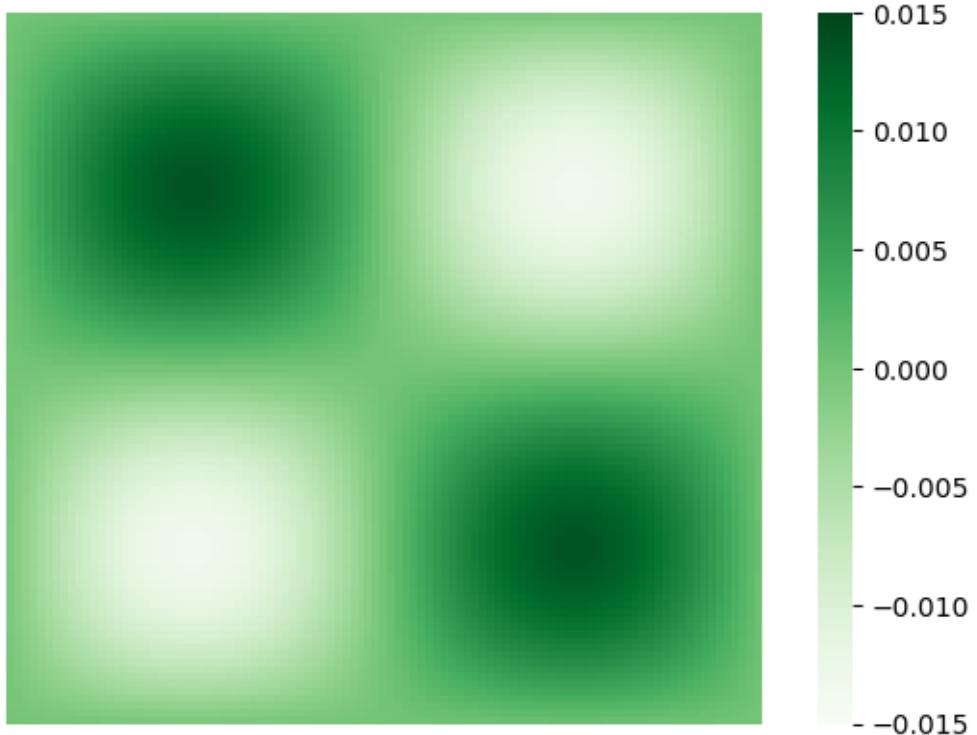
Q_4_Numerical_Solution_at_time_0.250000_.csv

Numerical Solution: Time = 0.25 s



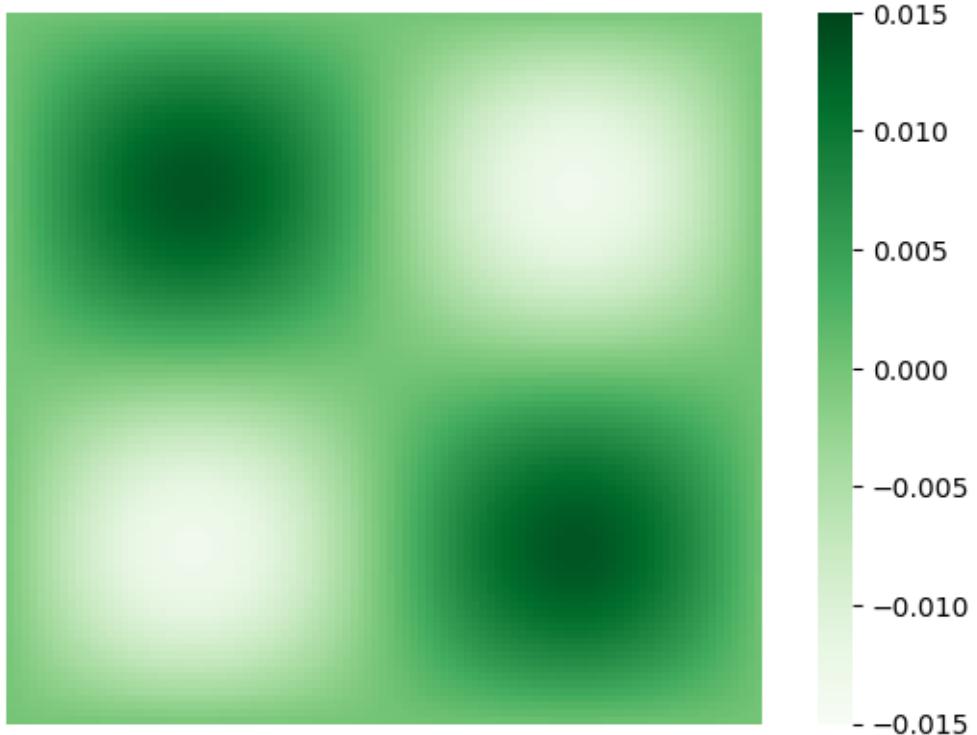
Q_4_Numerical_Solution_at_time_0.255000_.csv

Numerical Solution: Time = 0.255 s



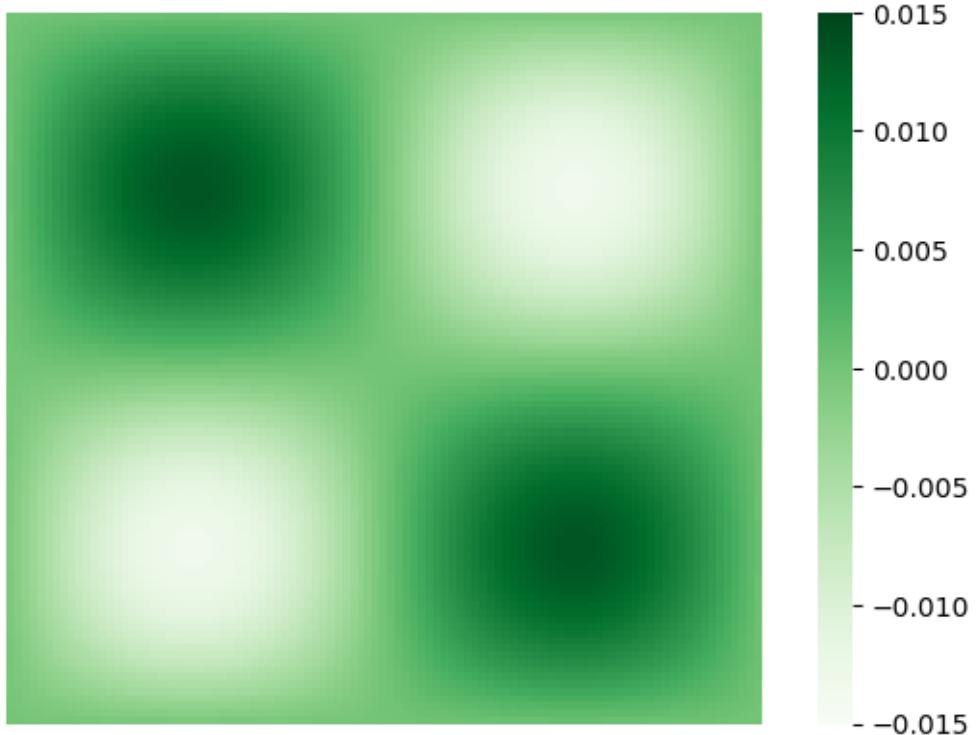
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Numerical Solution: Time = 0.26 s



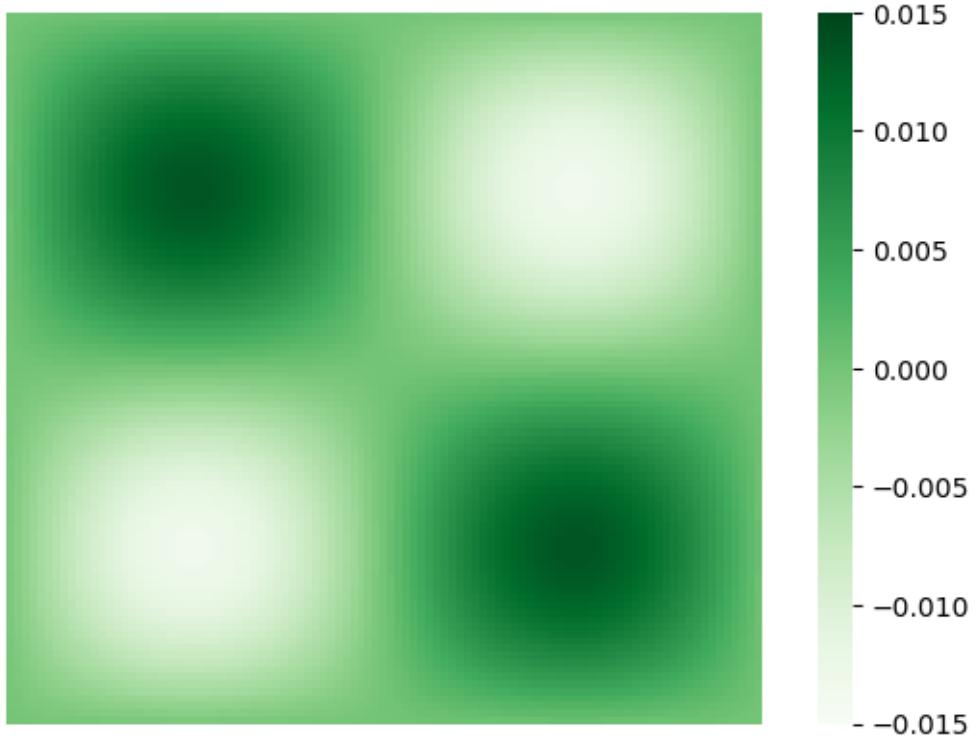
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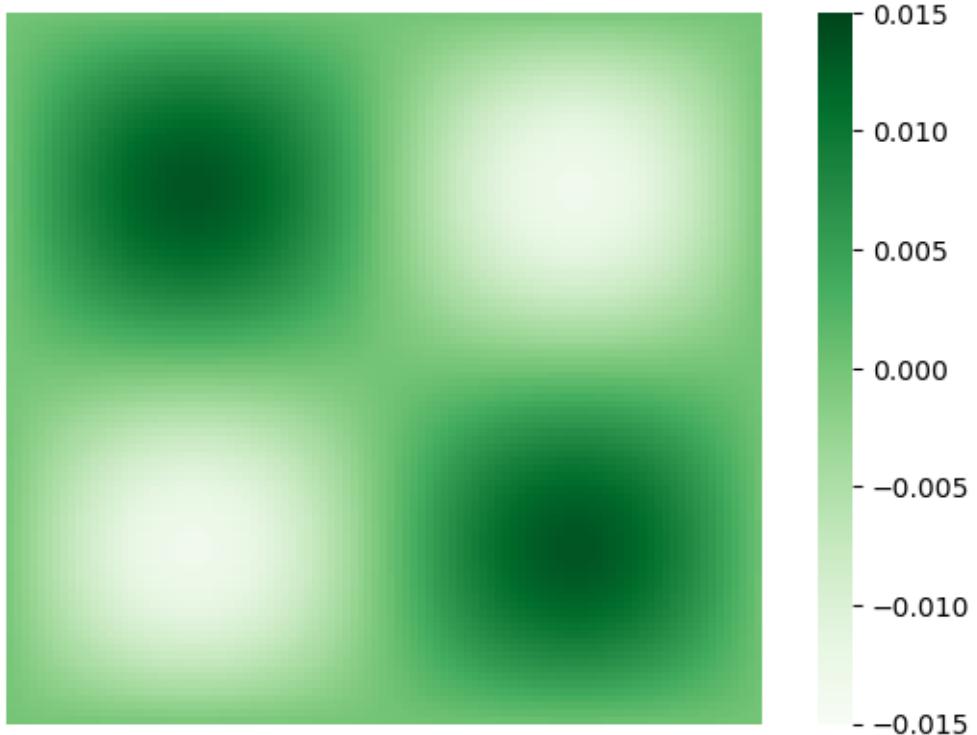
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Numerical Solution: Time = 0.27 s



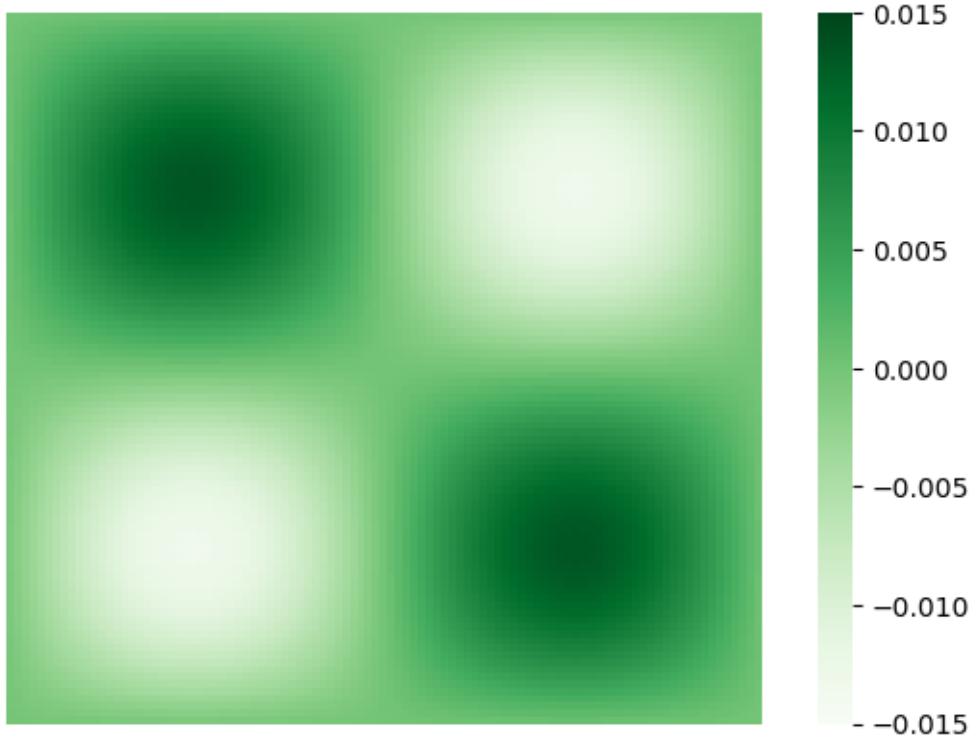
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Numerical Solution: Time = 0.275 s



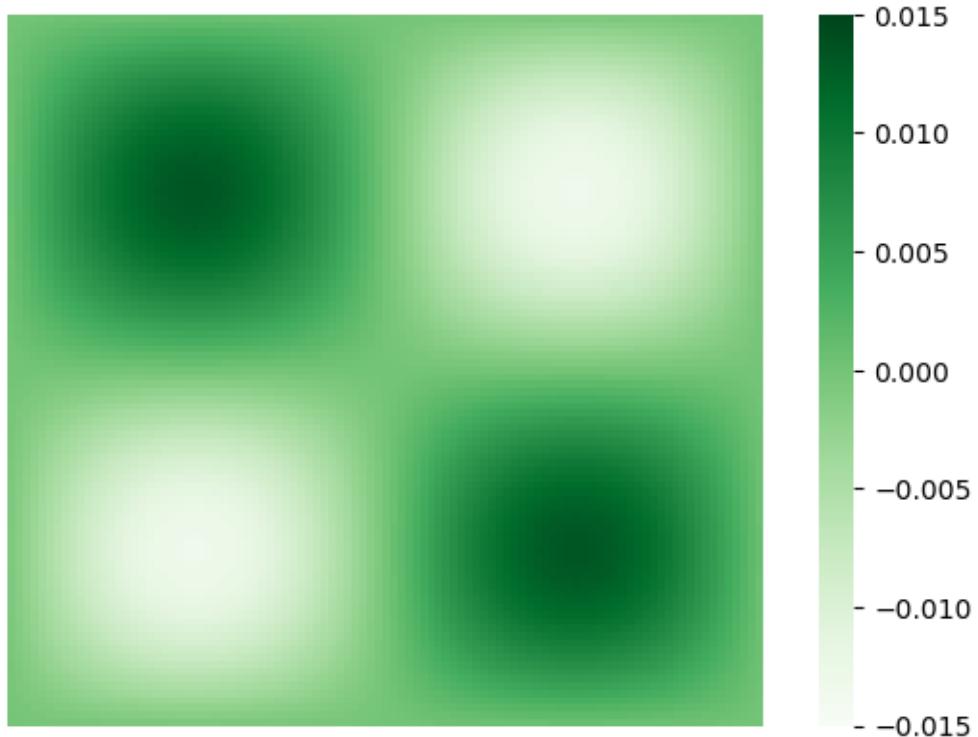
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Numerical Solution: Time = 0.28 s



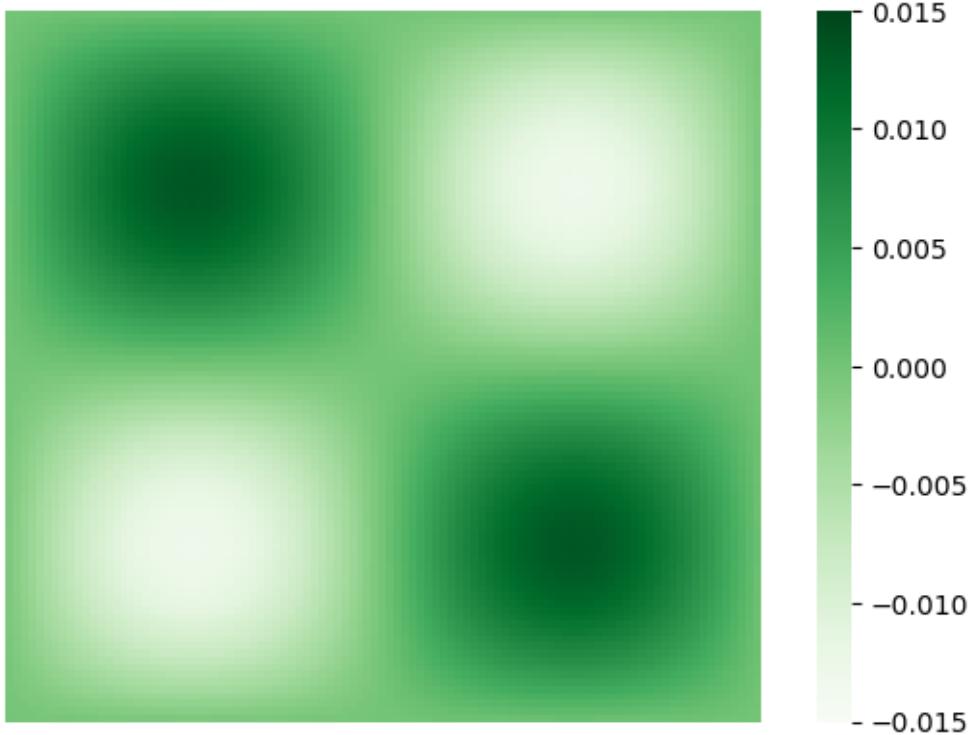
Q_4_Numerical_Solution_at_time_0.285000_.csv

Numerical Solution: Time = 0.28500000000000003 s



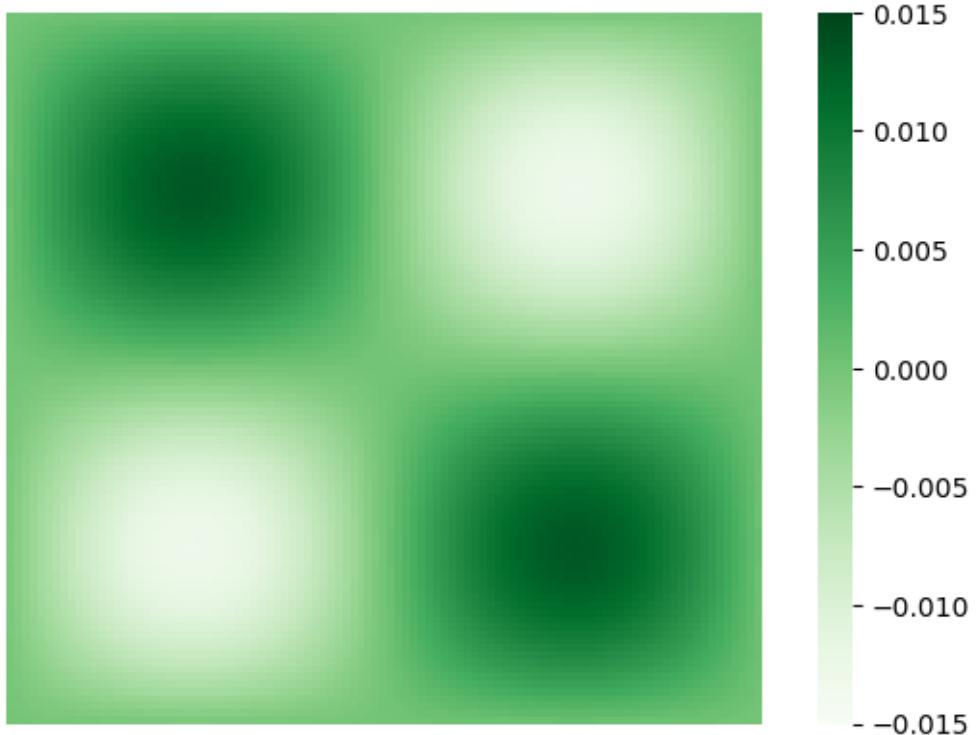
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Numerical Solution: Time = 0.29 s



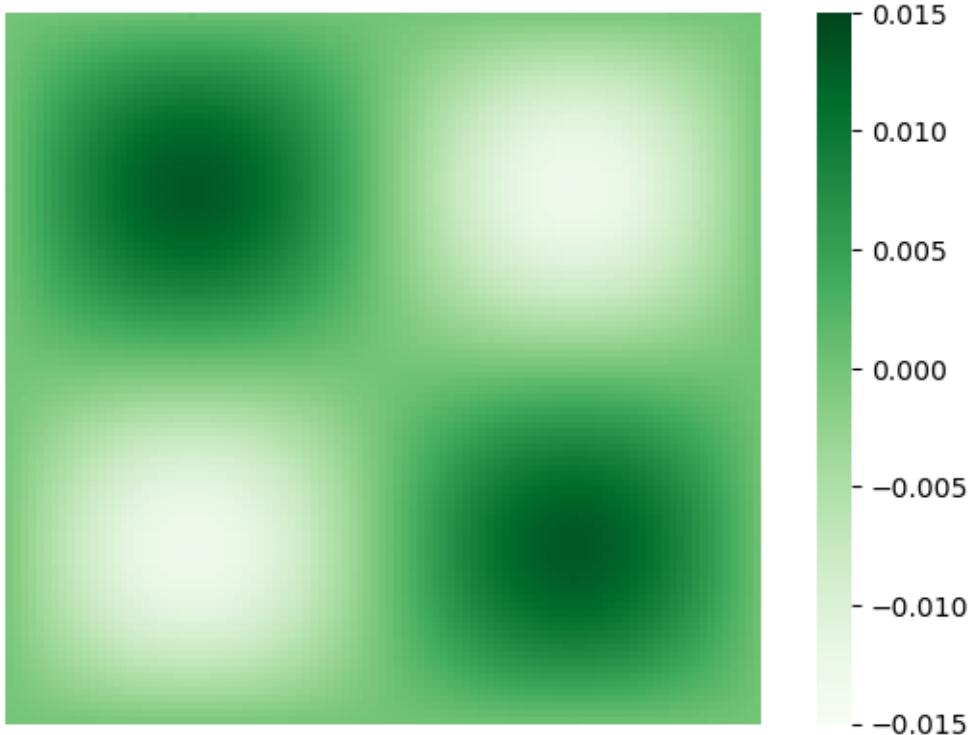
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Numerical Solution: Time = 0.295 s



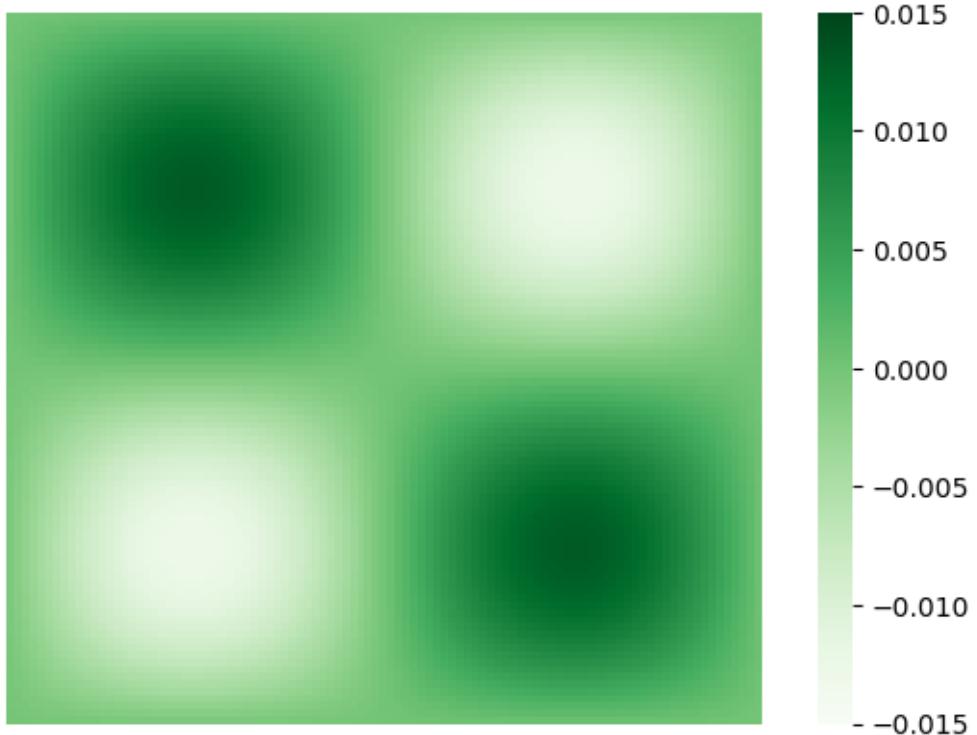
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Numerical Solution: Time = 0.3 s



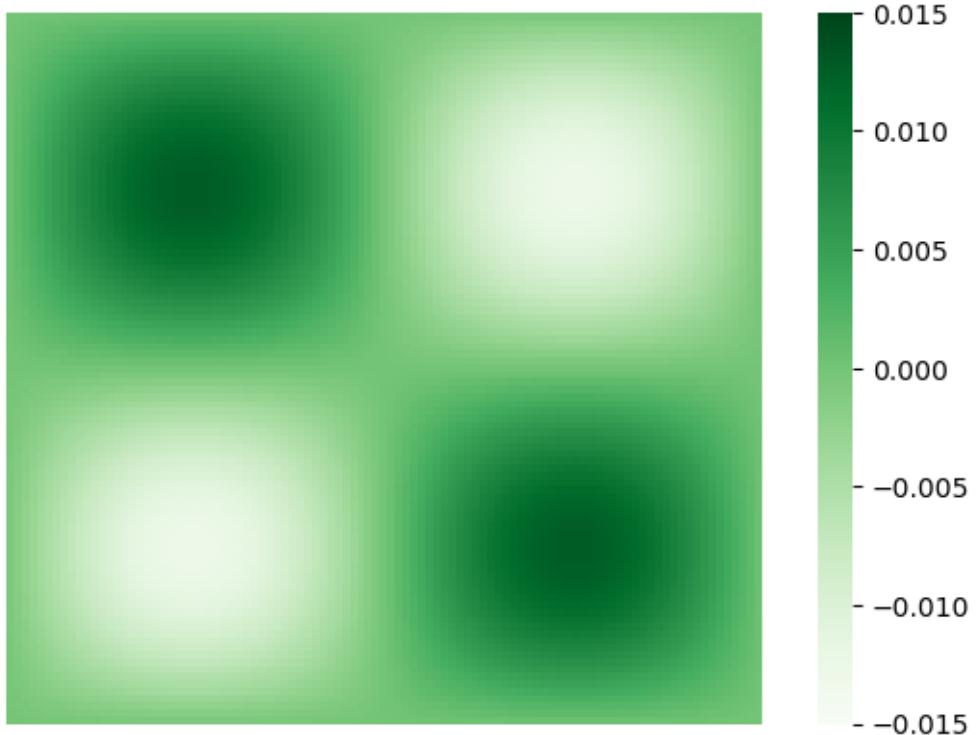
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Numerical Solution: Time = 0.305 s



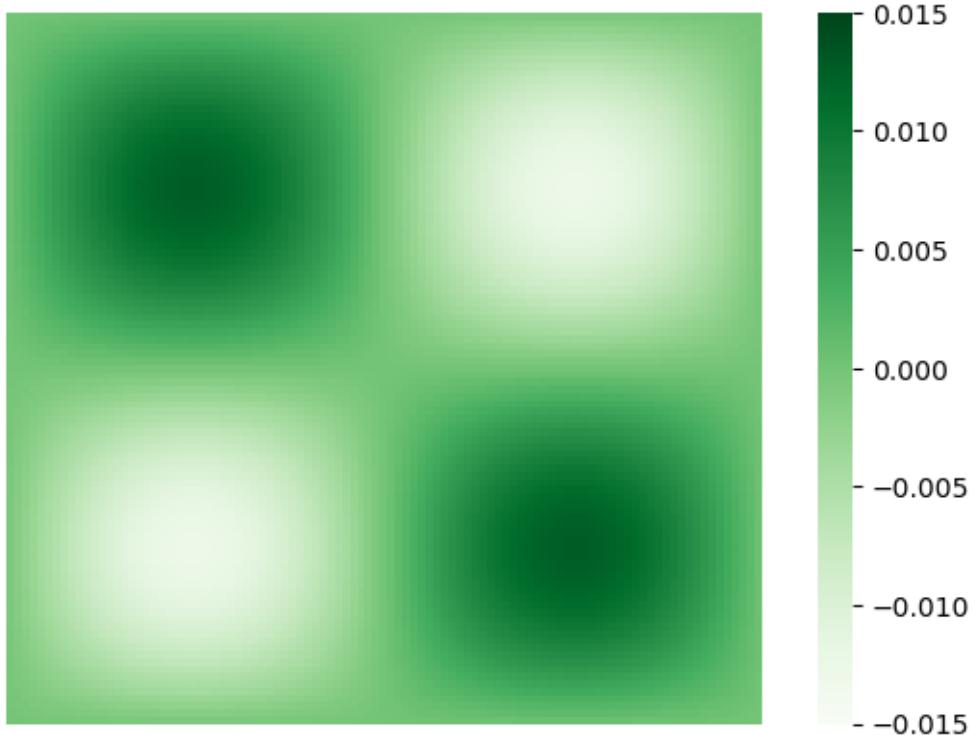
Q_4_Numerical_Solution_at_time_0.310000_.csv

Numerical Solution: Time = 0.31 s



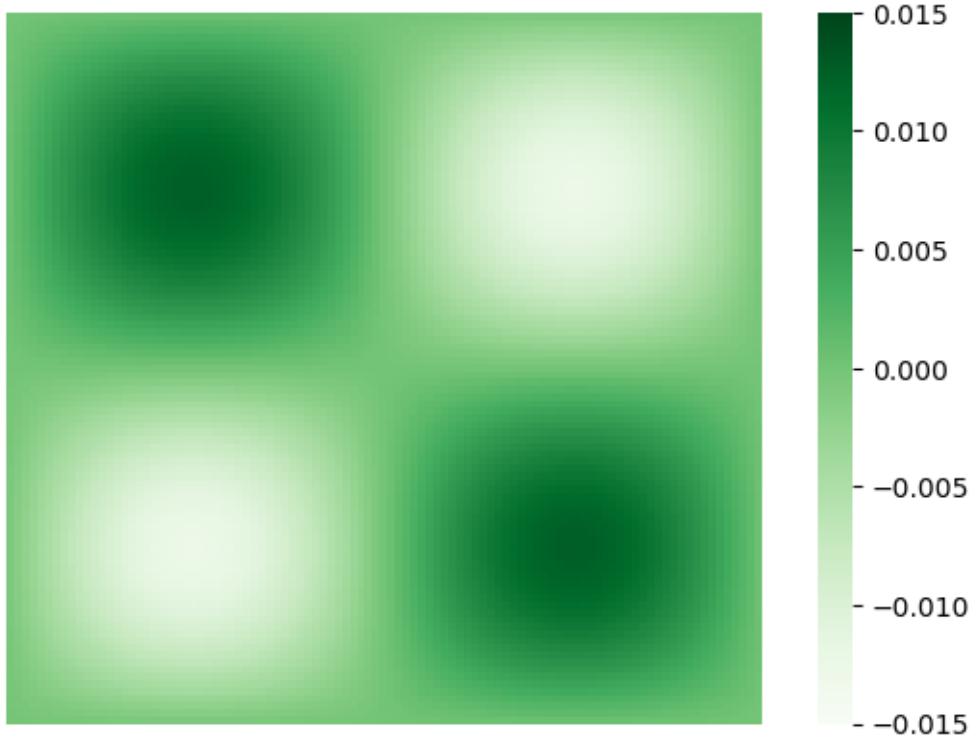
Q_4_Numerical_Solution_at_time_0.315000_.csv

Numerical Solution: Time = 0.315 s



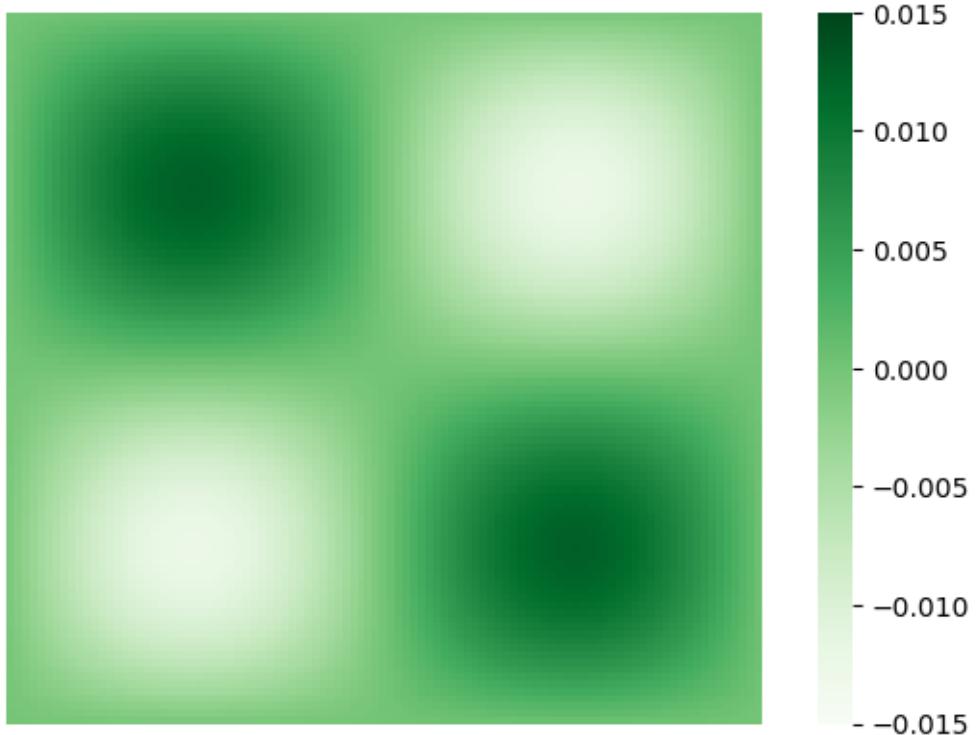
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Numerical Solution: Time = 0.32 s



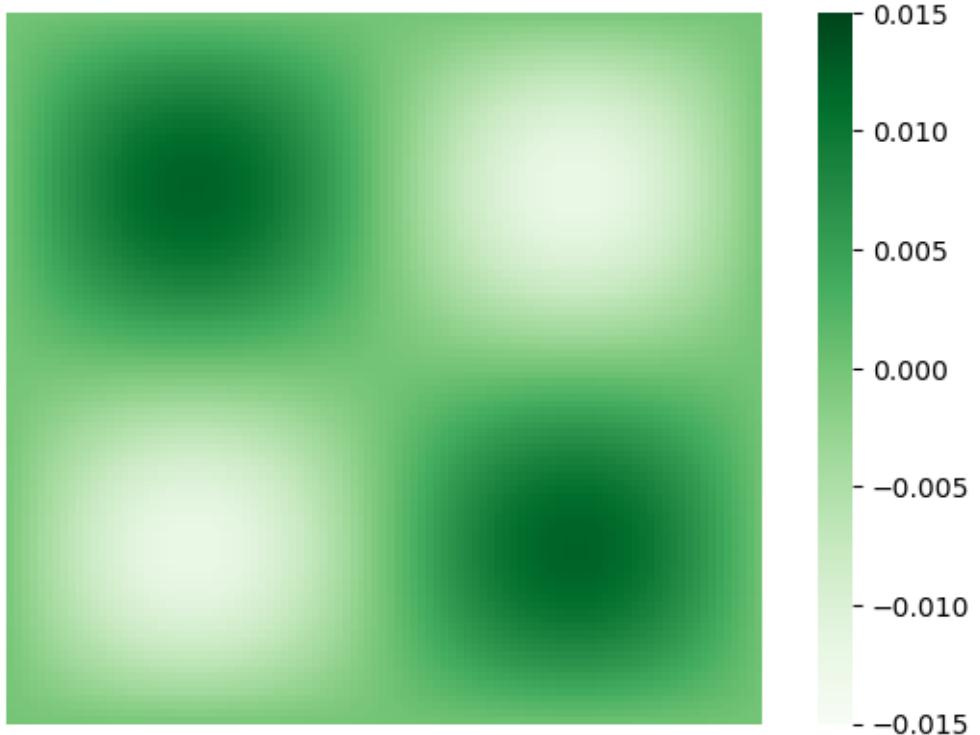
Q_4_Numerical_Solution_at_time_0.325000_.csv

Numerical Solution: Time = 0.325 s



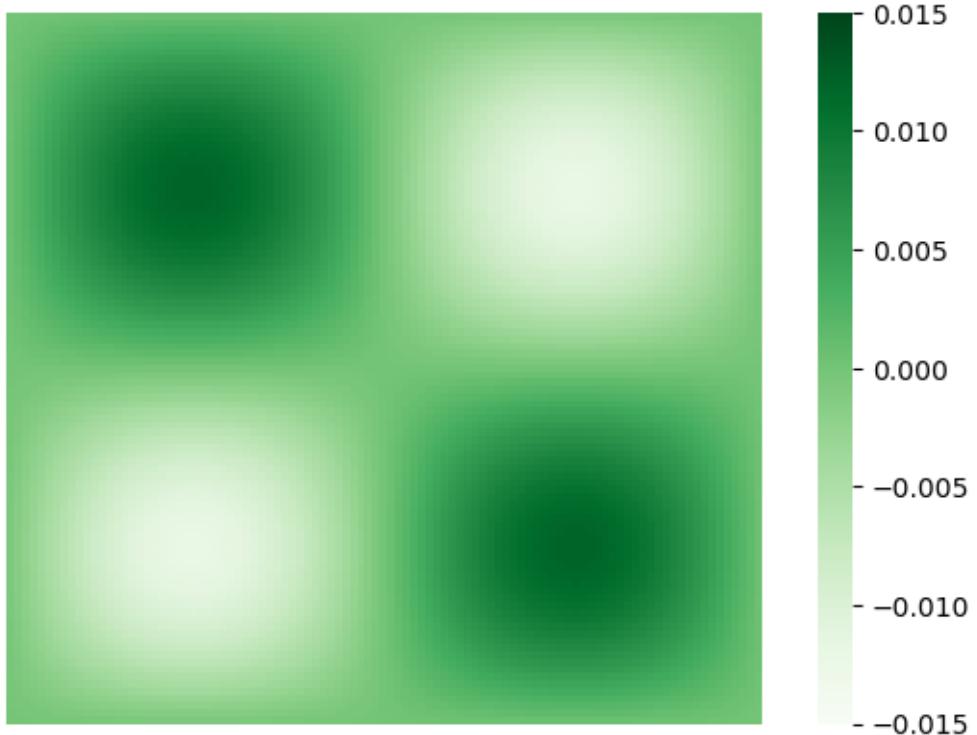
Q_4_Numerical_Solution_at_time_0.330000_.csv

Numerical Solution: Time = 0.33 s



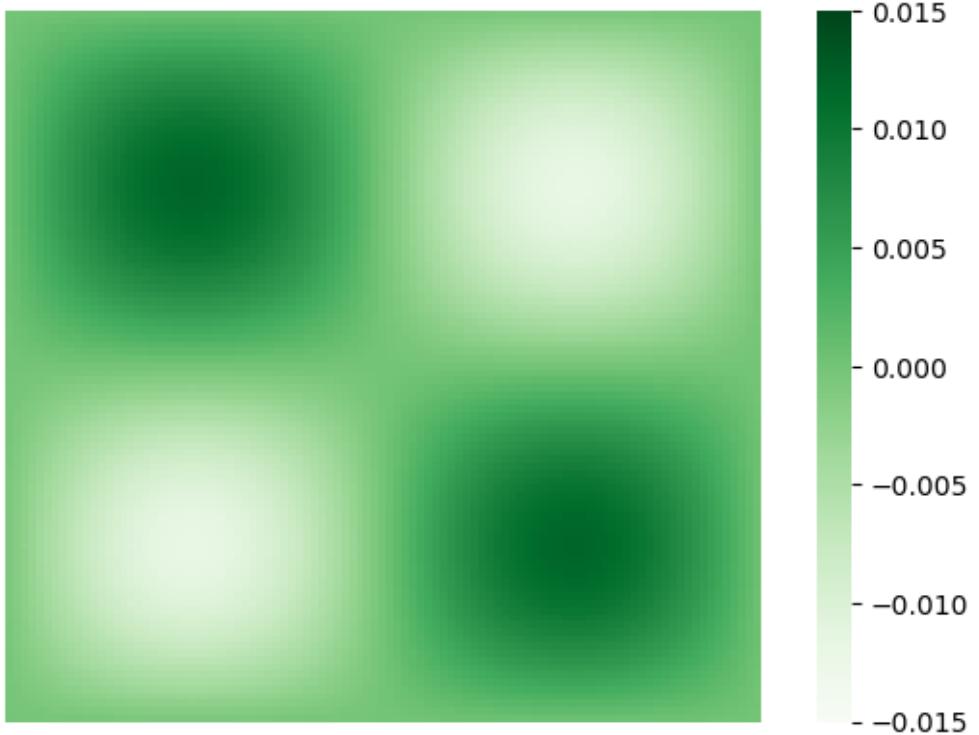
Q_4_Numerical_Solution_at_time_0.335000_.csv

Numerical Solution: Time = 0.335 s



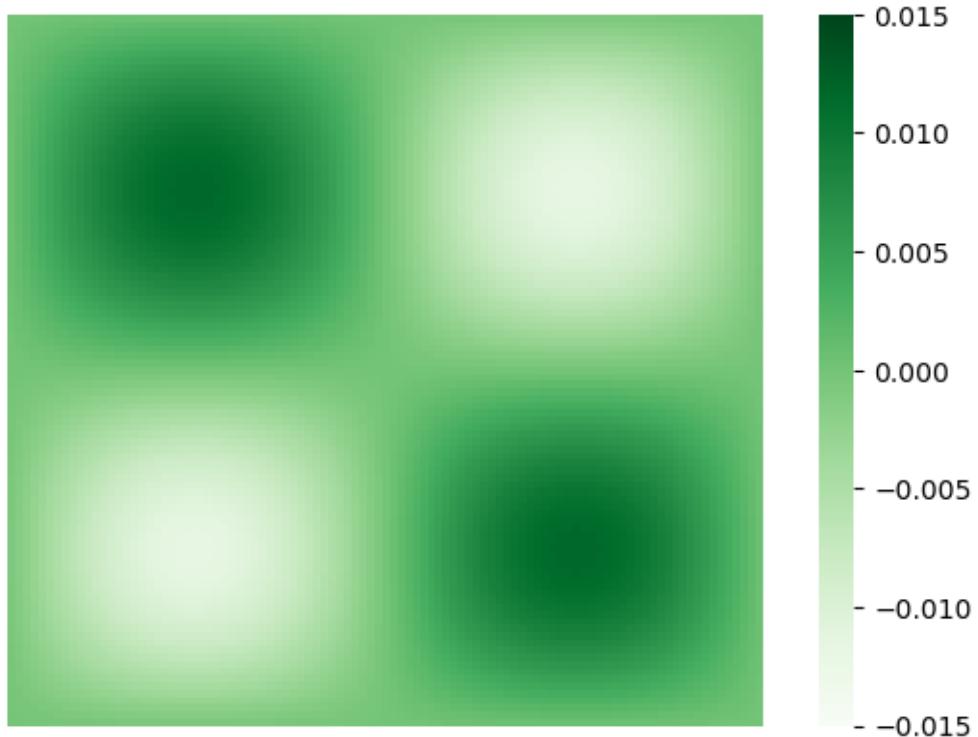
Q_4_Numerical_Solution_at_time_0.340000_.csv

Numerical Solution: Time = 0.34 s



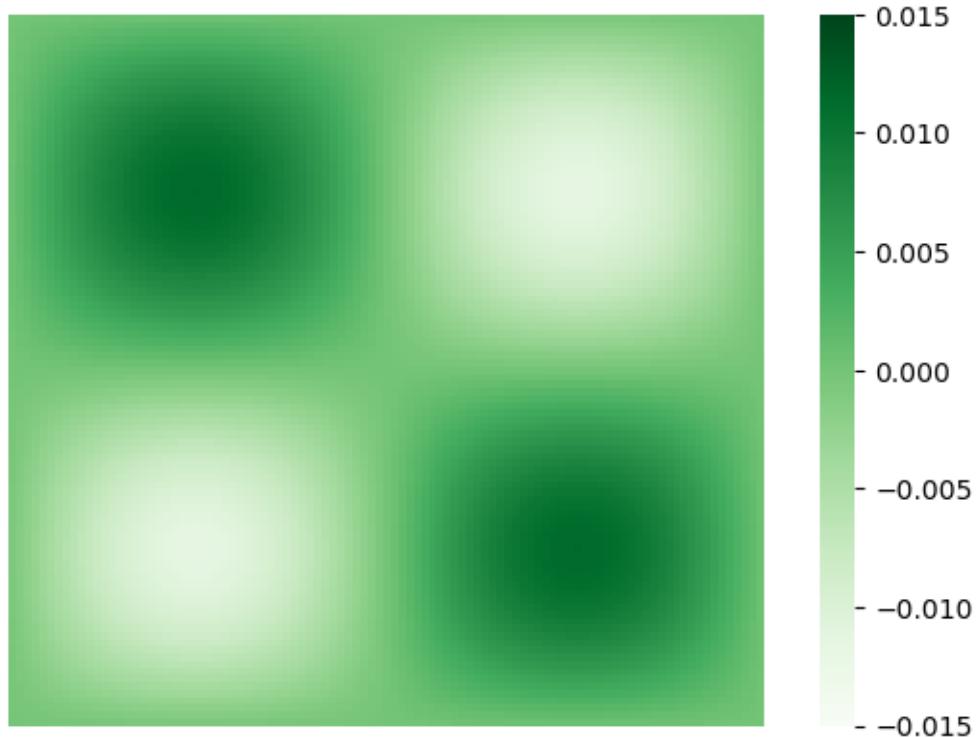
Q_4_Numerical_Solution_at_time_0.345000_.csv

Numerical Solution: Time = 0.3450000000000003 s



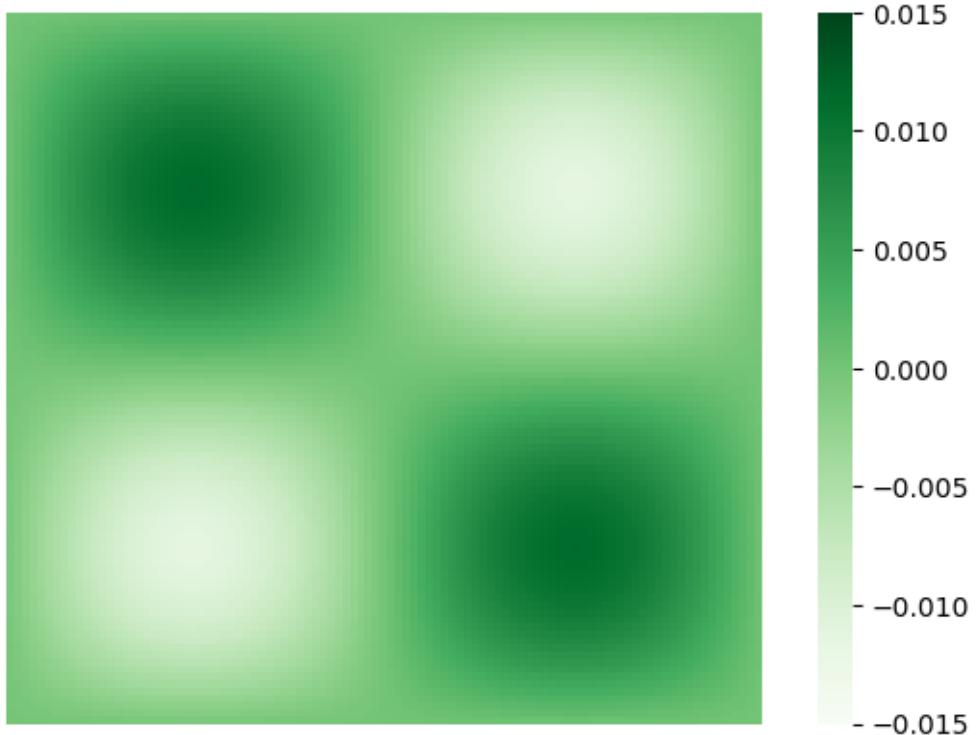
Q_4_Numerical_Solution_at_time_0.350000_.csv

Numerical Solution: Time = 0.3500000000000003 s



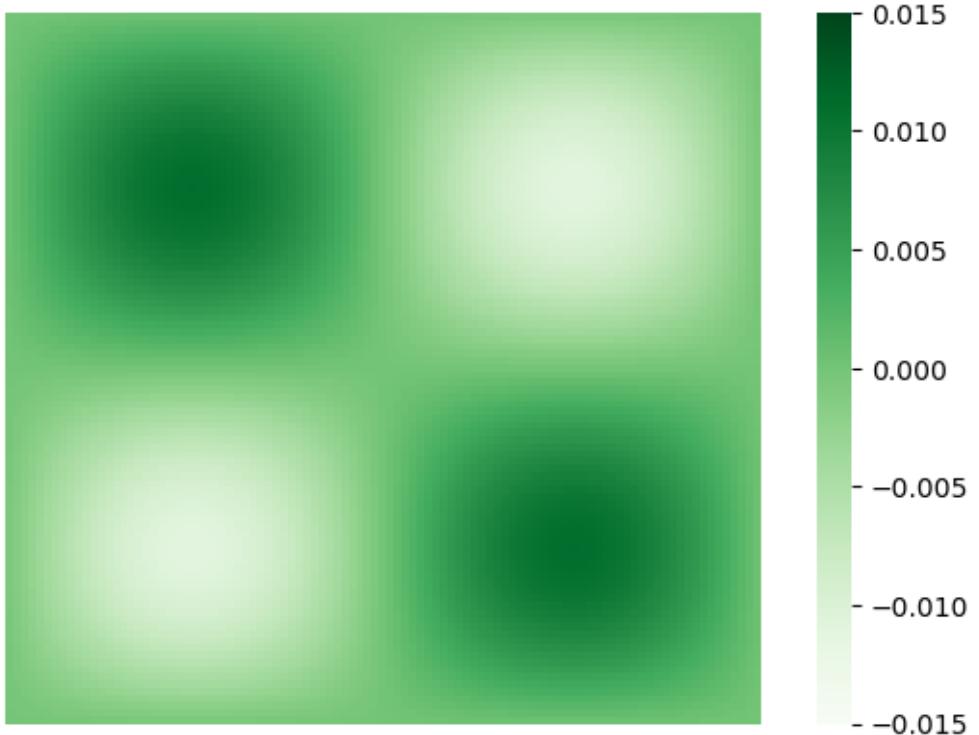
Q_4_Numerical_Solution_at_time_0.355000_.csv

Numerical Solution: Time = 0.355 s



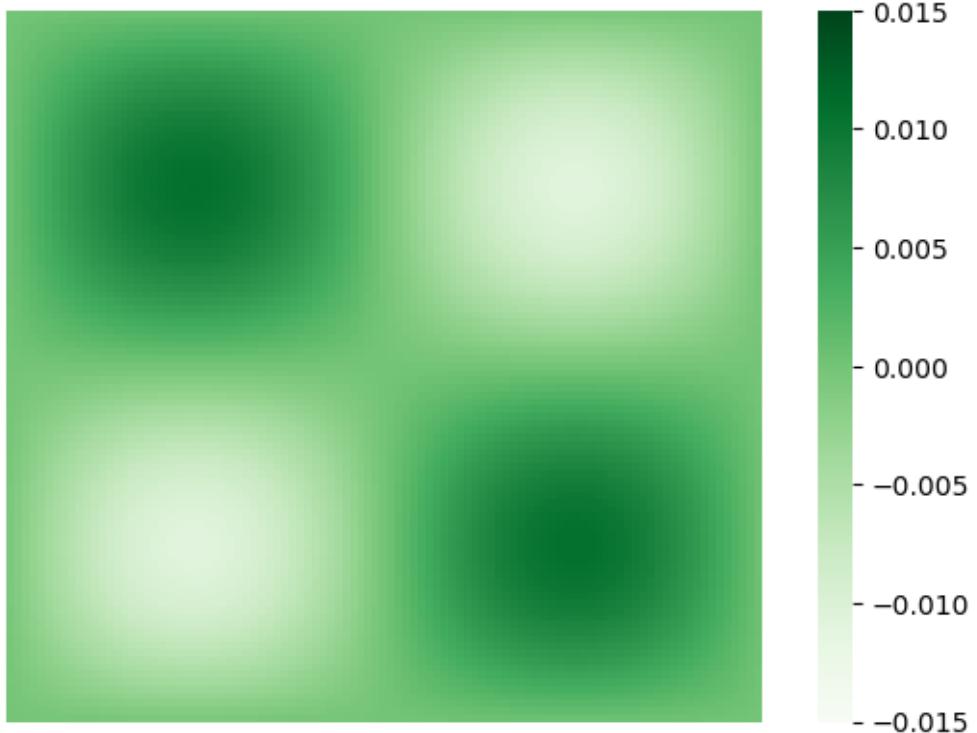
Q_4_Numerical_Solution_at_time_0.360000_.csv

Numerical Solution: Time = 0.36 s



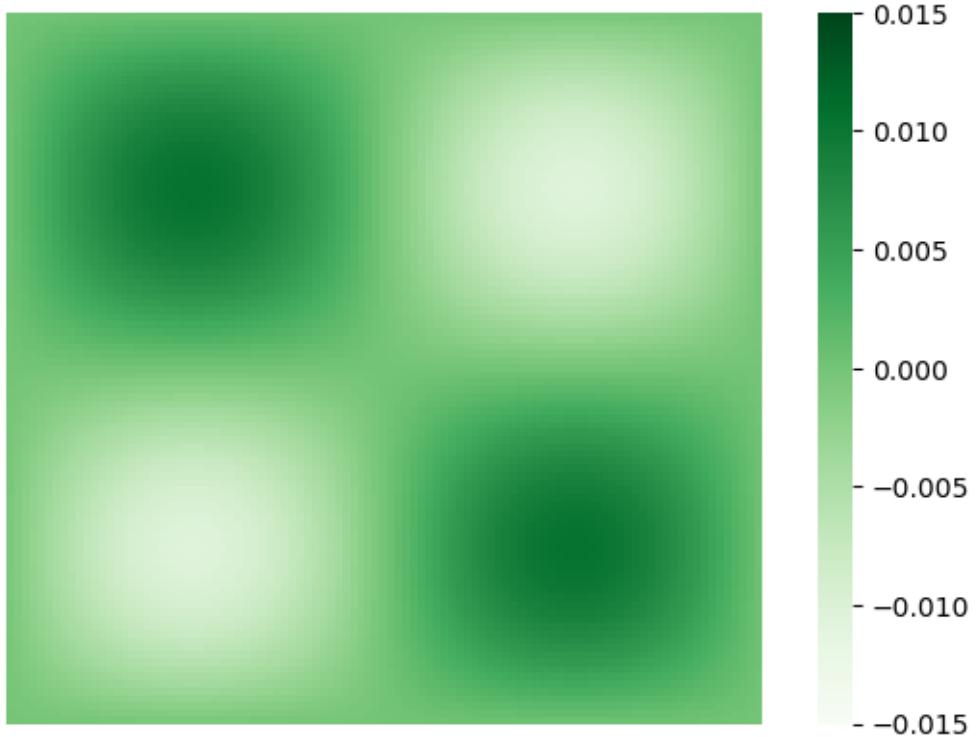
Q_4_Numerical_Solution_at_time_0.365000_.csv

Numerical Solution: Time = 0.365 s



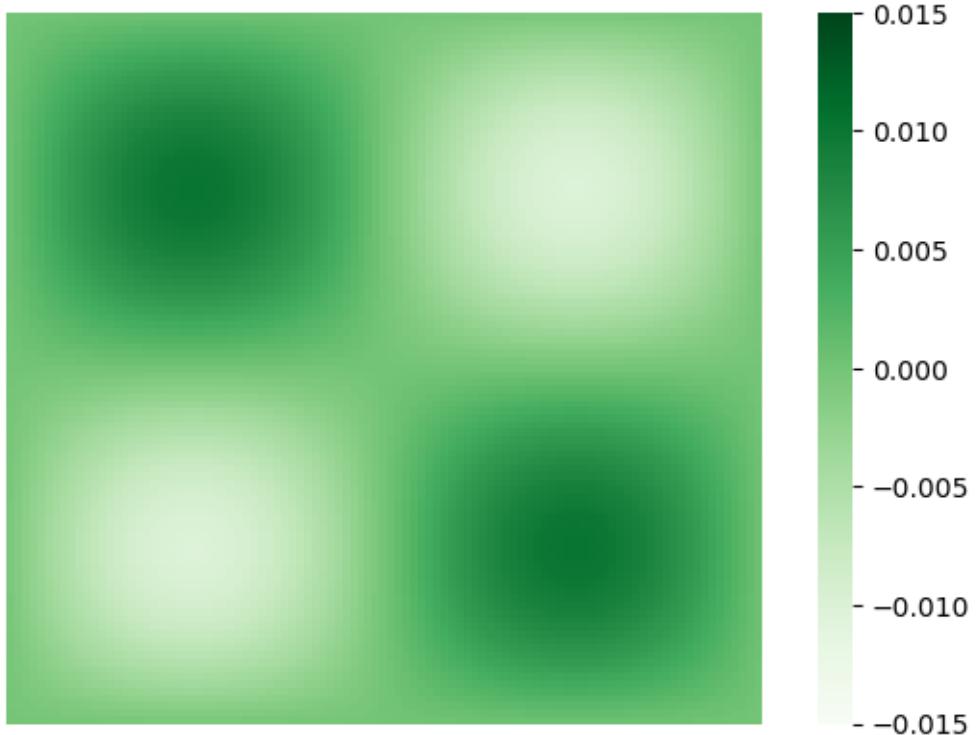
Q_4_Numerical_Solution_at_time_0.370000_.csv

Numerical Solution: Time = 0.37 s



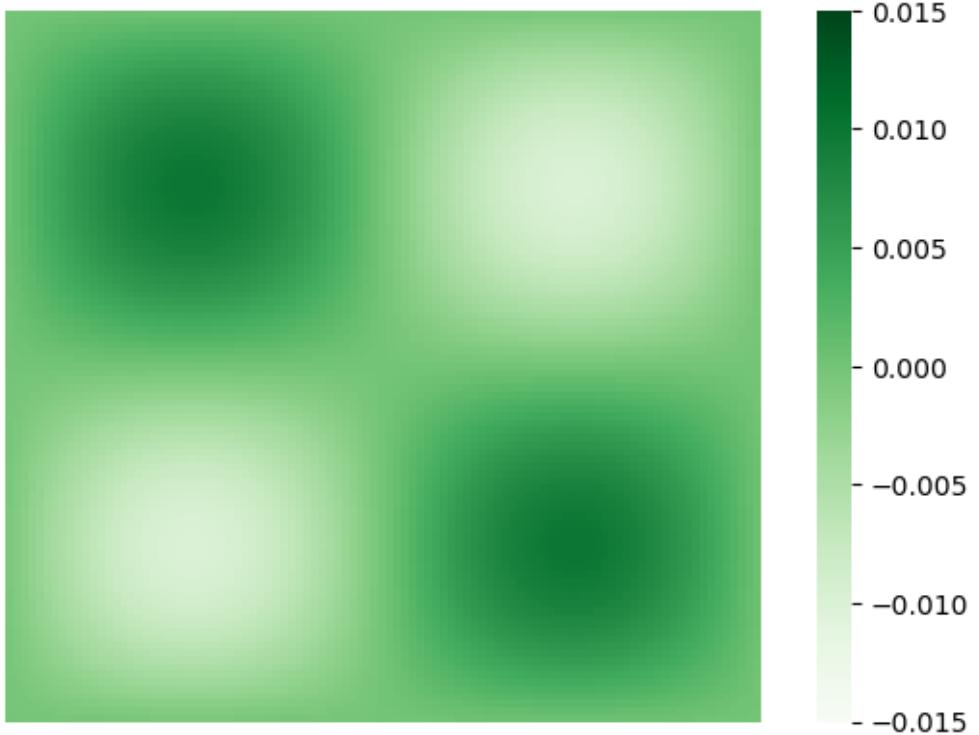
Q_4_Numerical_Solution_at_time_0.375000_.csv

Numerical Solution: Time = 0.375 s



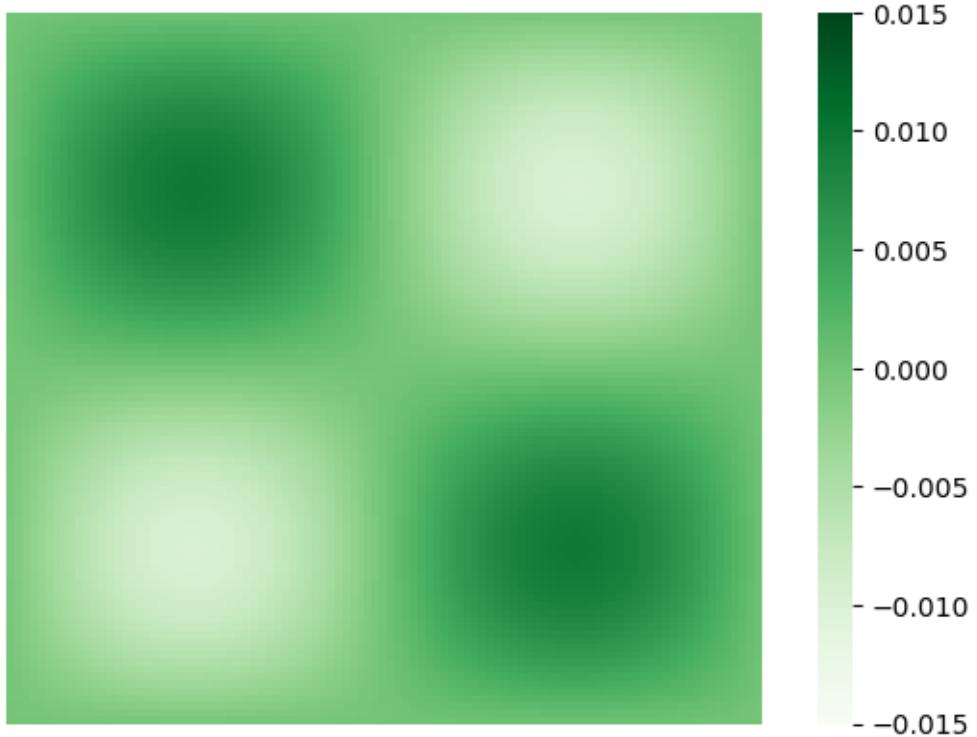
Q_4_Numerical_Solution_at_time_0.380000_.csv

Numerical Solution: Time = 0.38 s



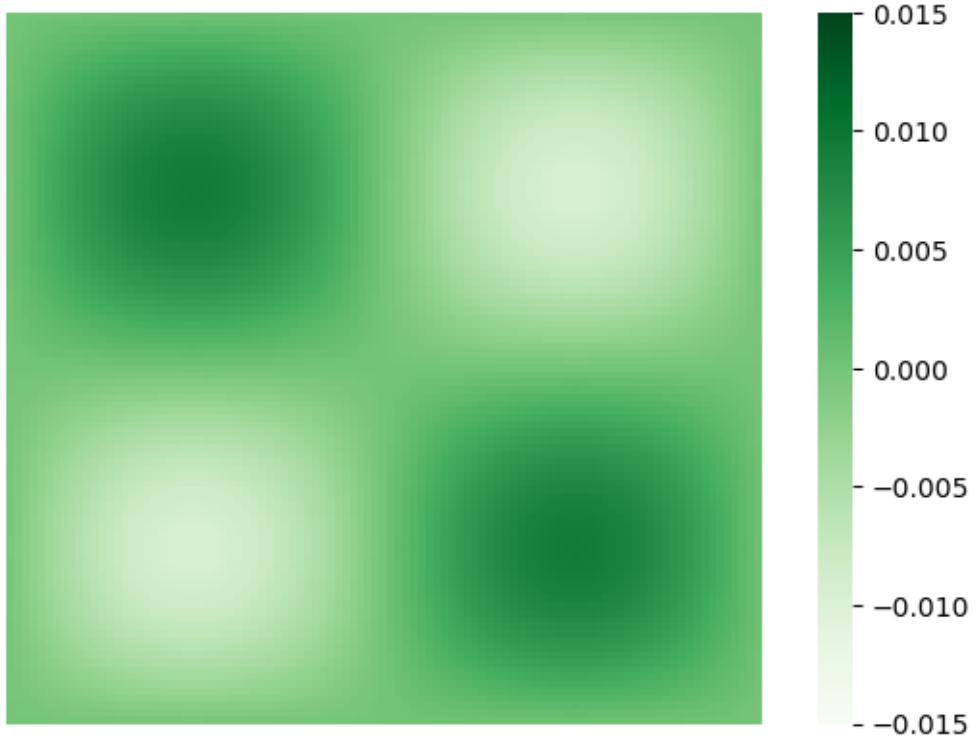
Q_4_Numerical_Solution_at_time_0.385000_.csv

Numerical Solution: Time = 0.385 s



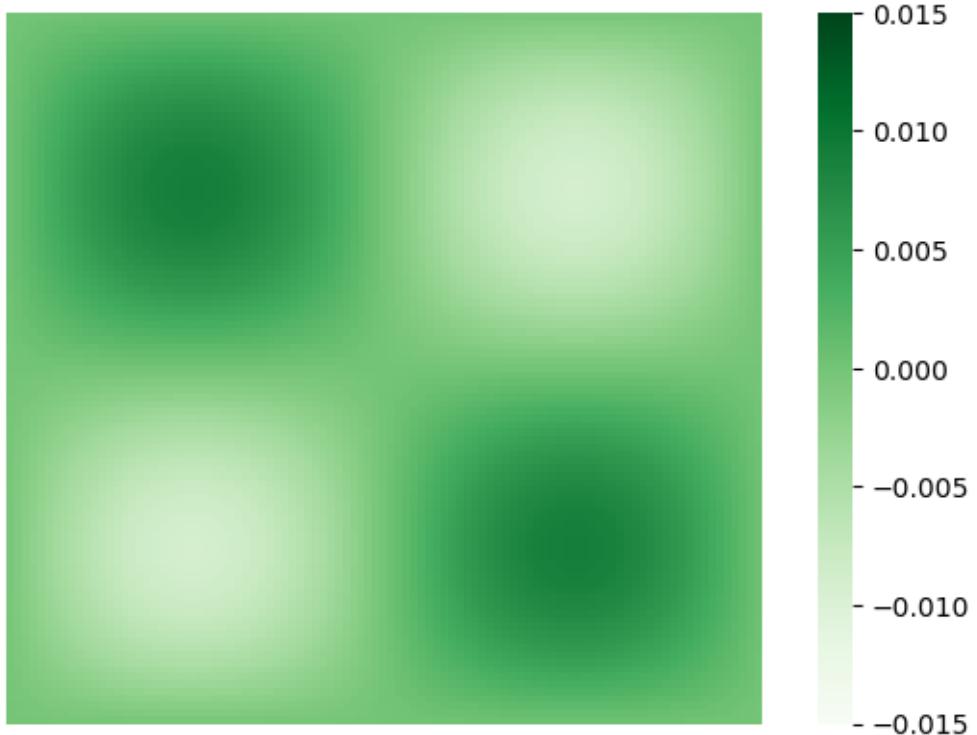
Q_4_Numerical_Solution_at_time_0.390000_.csv

Numerical Solution: Time = 0.39 s



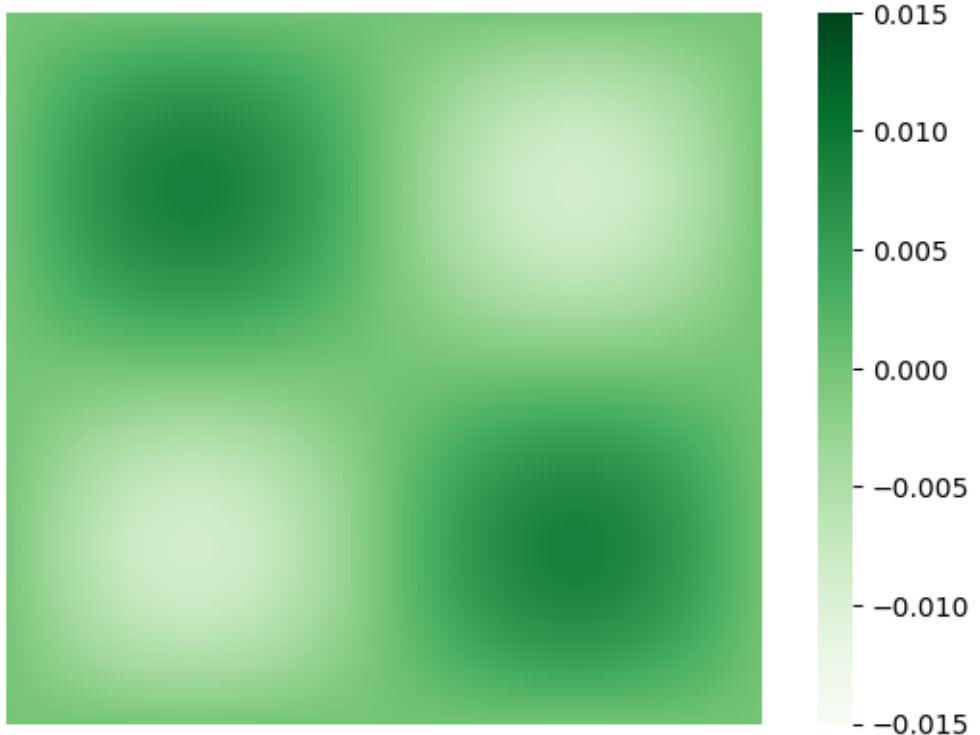
Q_4_Numerical_Solution_at_time_0.395000_.csv

Numerical Solution: Time = 0.395 s



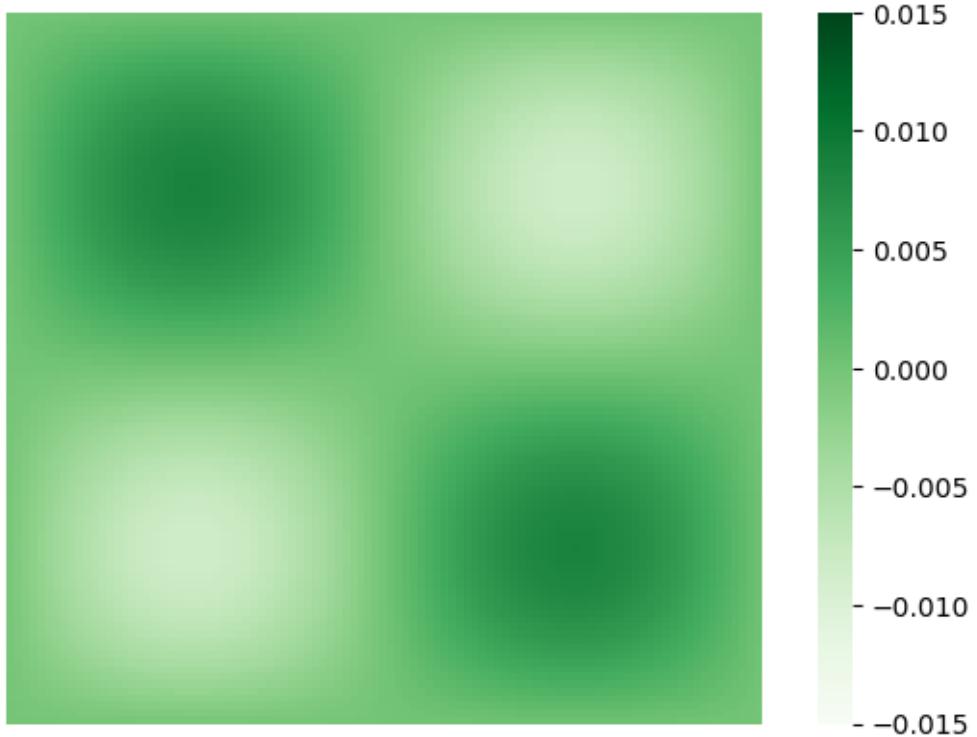
Q_4_Numerical_Solution_at_time_0.400000_.csv

Numerical Solution: Time = 0.4 s



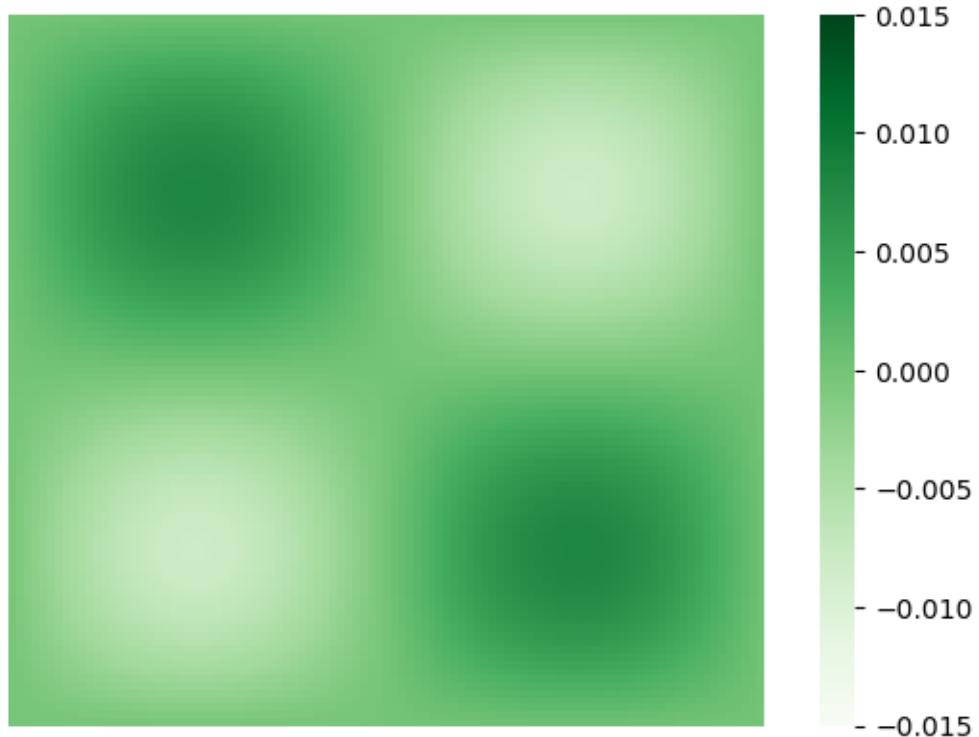
Q_4_Numerical_Solution_at_time_0.405000_.csv

Numerical Solution: Time = 0.405 s



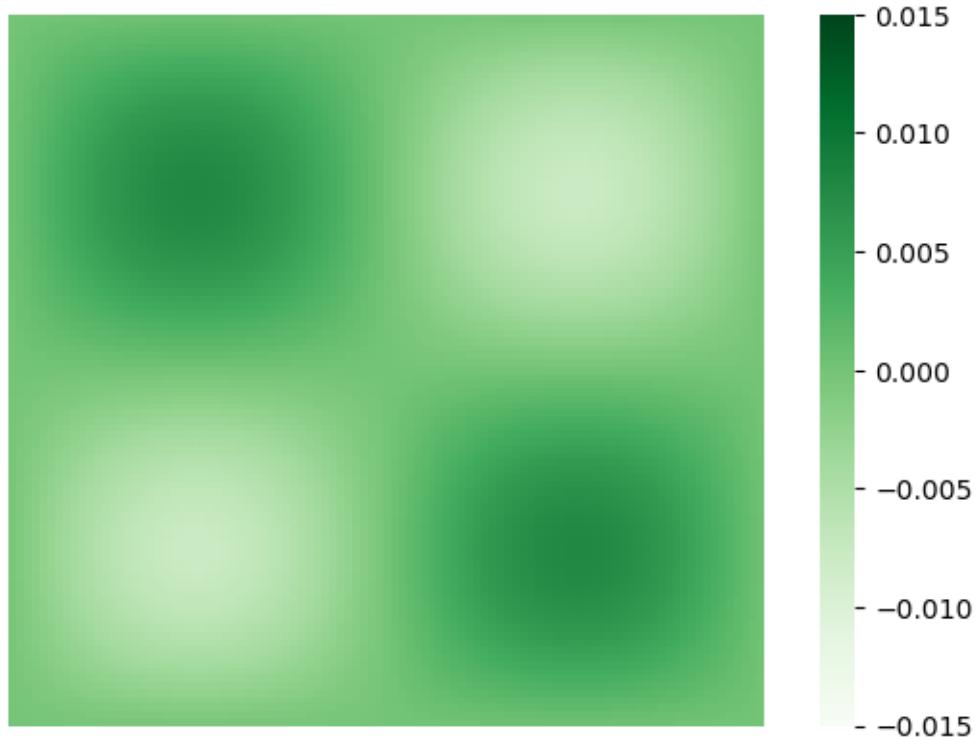
Q_4_Numerical_Solution_at_time_0.410000_.csv

Numerical Solution: Time = 0.4100000000000003 s



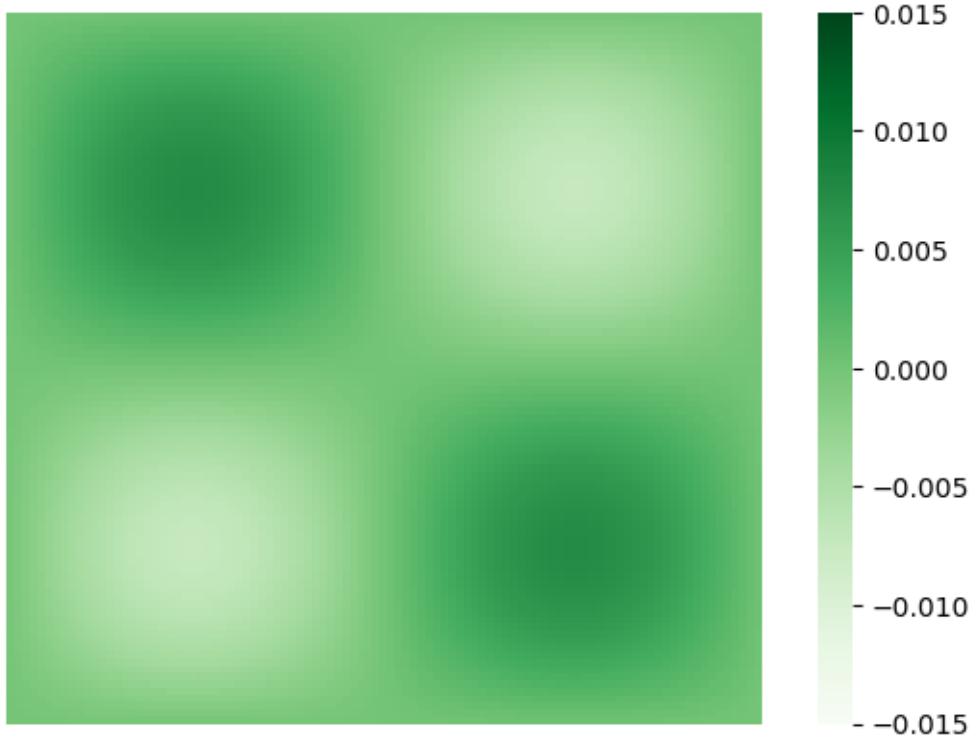
Q_4_Numerical_Solution_at_time_0.415000_.csv

Numerical Solution: Time = 0.4150000000000004 s



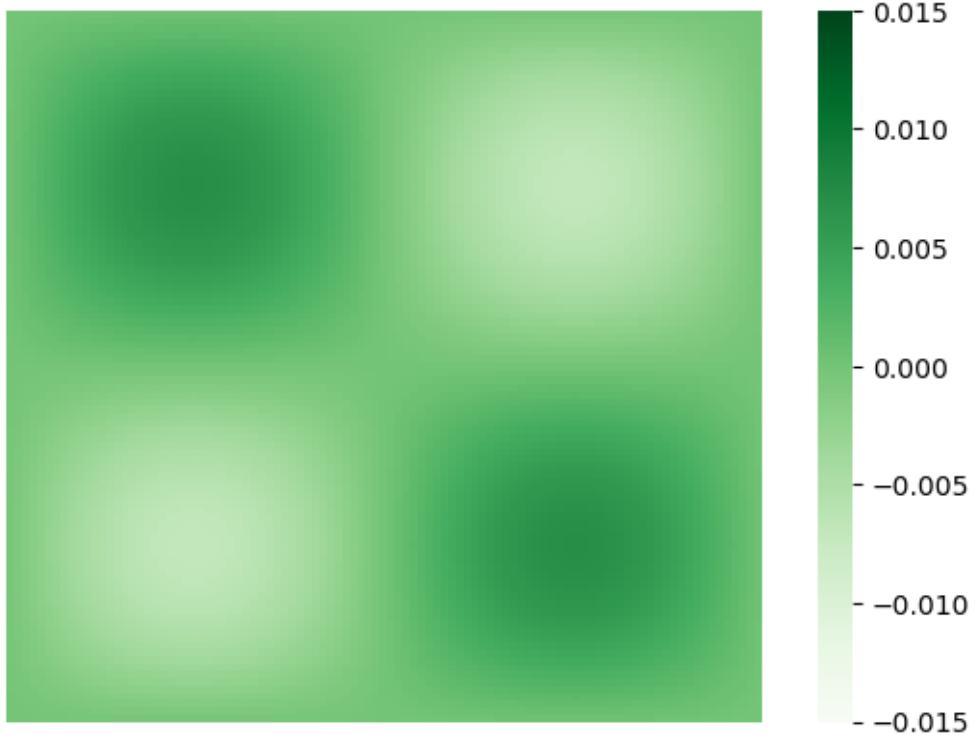
Q_4_Numerical_Solution_at_time_0.420000_.csv

Numerical Solution: Time = 0.42 s



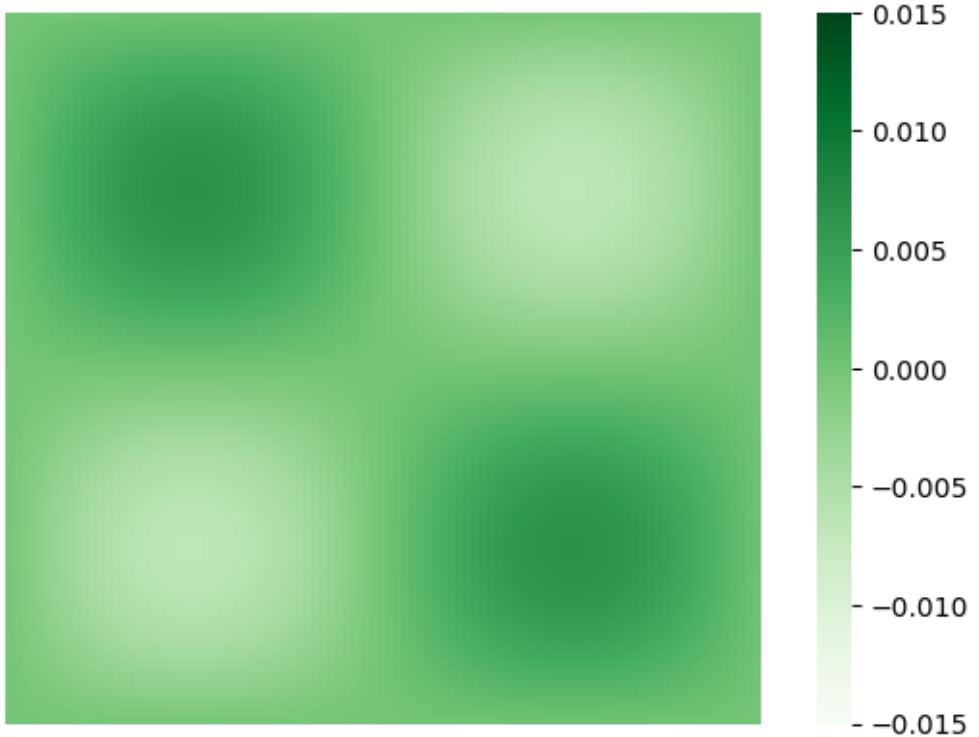
Q_4_Numerical_Solution_at_time_0.425000_.csv

Numerical Solution: Time = 0.425 s



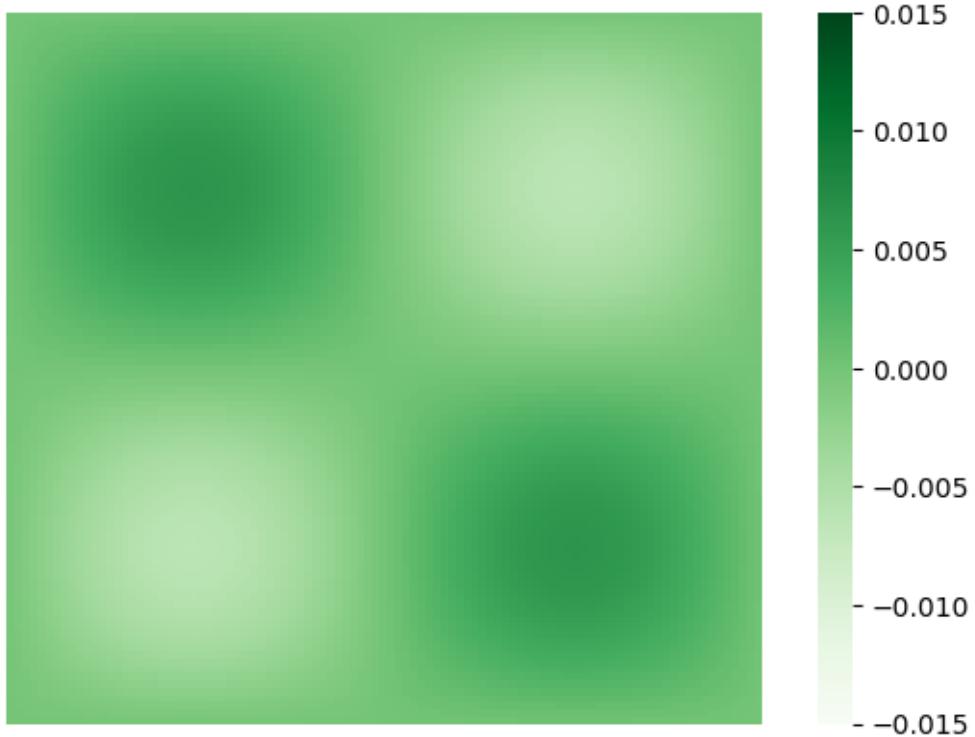
Q_4_Numerical_Solution_at_time_0.430000_.csv

Numerical Solution: Time = 0.43 s



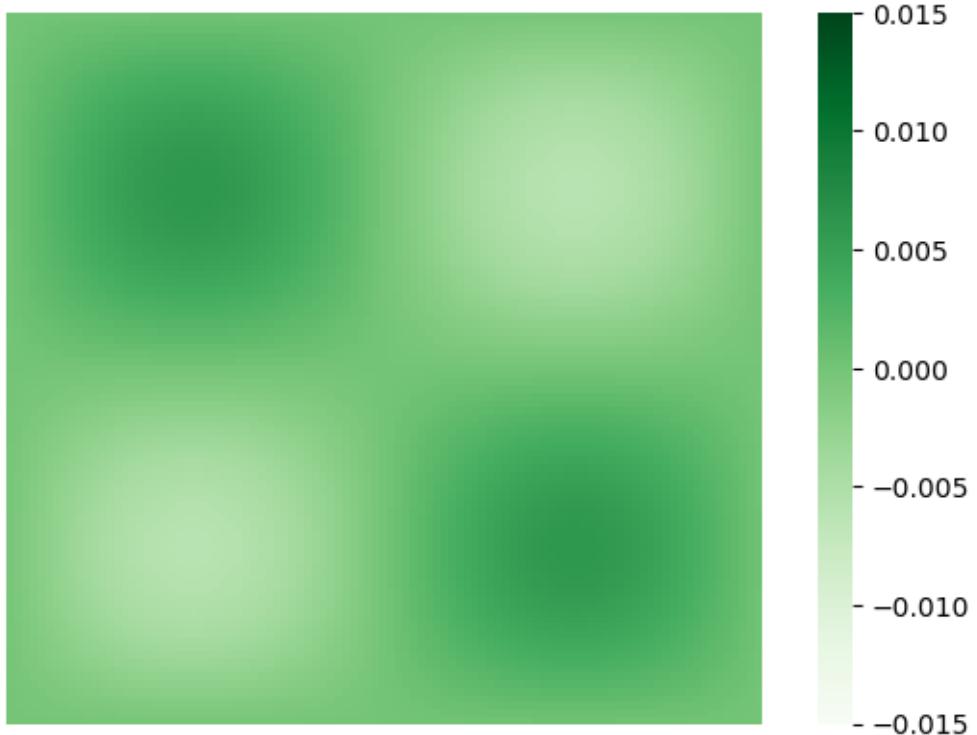
Q_4_Numerical_Solution_at_time_0.435000_.csv

Numerical Solution: Time = 0.435 s



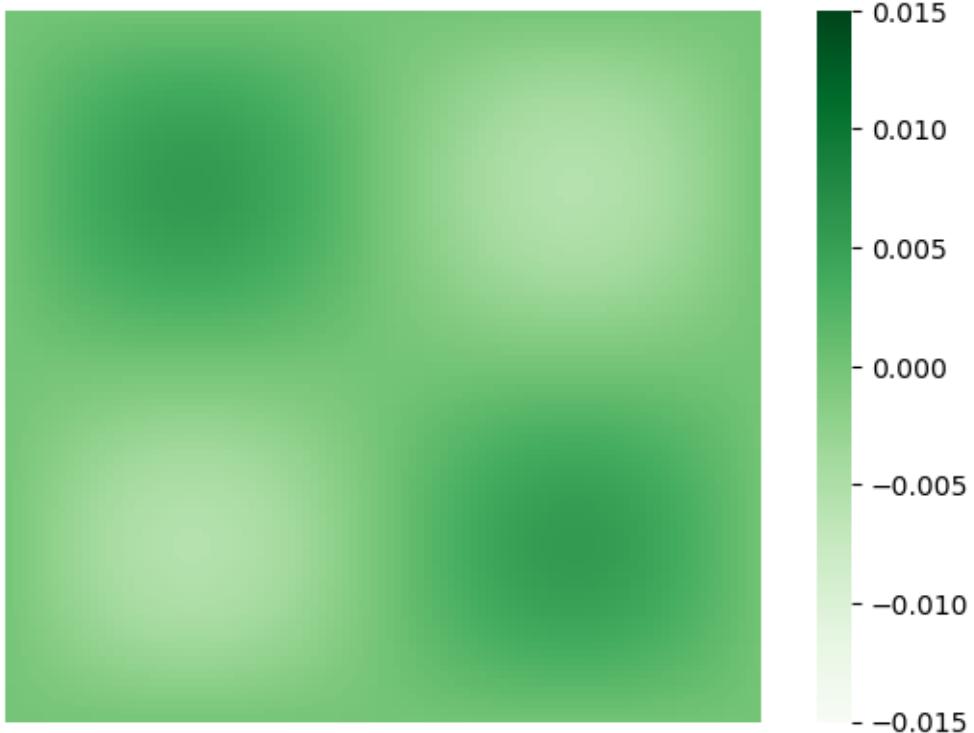
Q_4_Numerical_Solution_at_time_0.440000_.csv

Numerical Solution: Time = 0.44 s



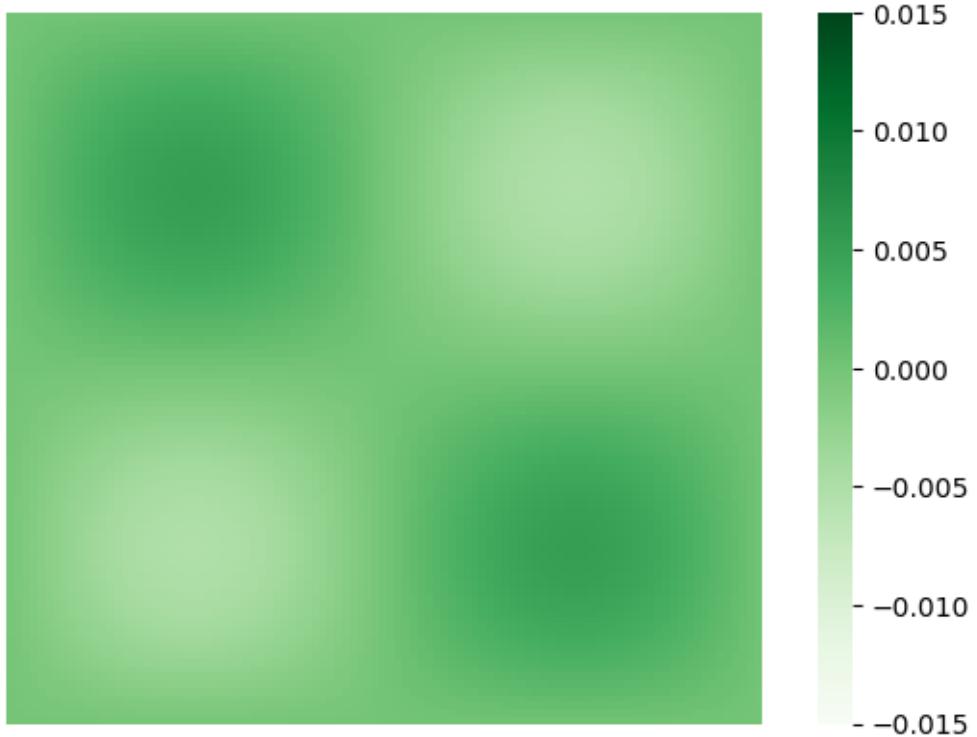
Q_4_Numerical_Solution_at_time_0.445000_.csv

Numerical Solution: Time = 0.445 s



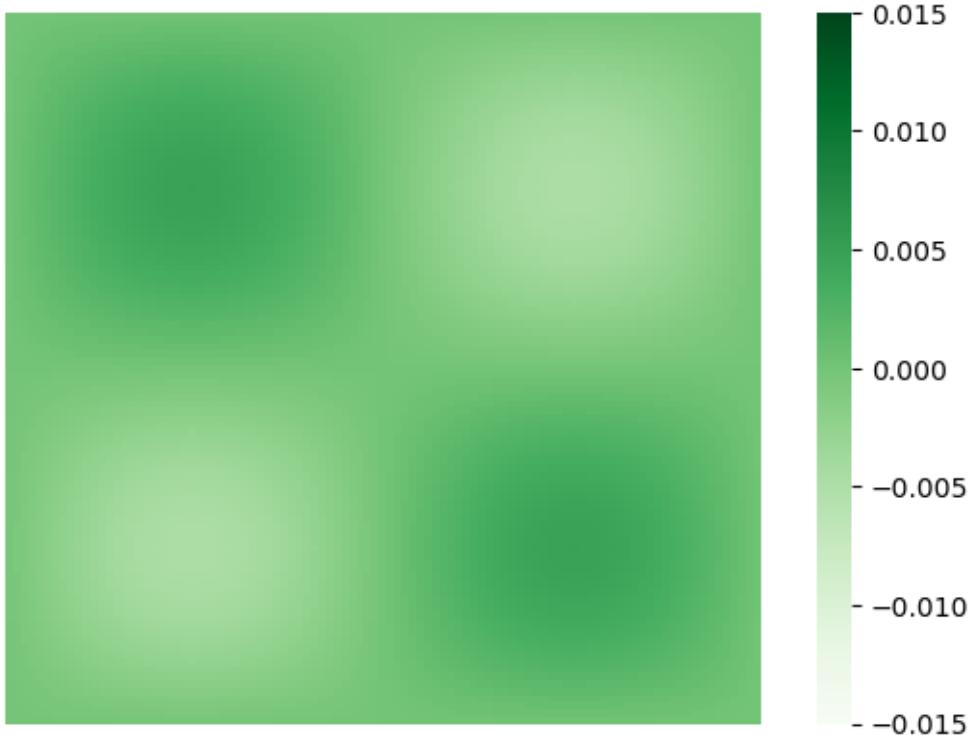
Q_4_Numerical_Solution_at_time_0.450000_.csv

Numerical Solution: Time = 0.45 s



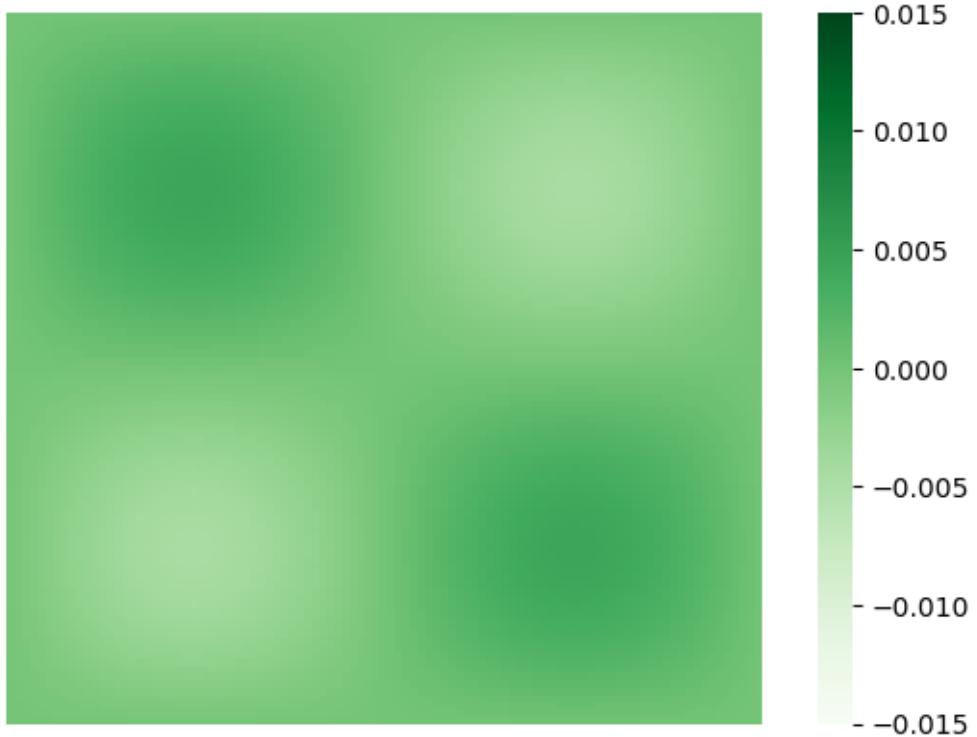
Q_4_Numerical_Solution_at_time_0.455000_.csv

Numerical Solution: Time = 0.455 s



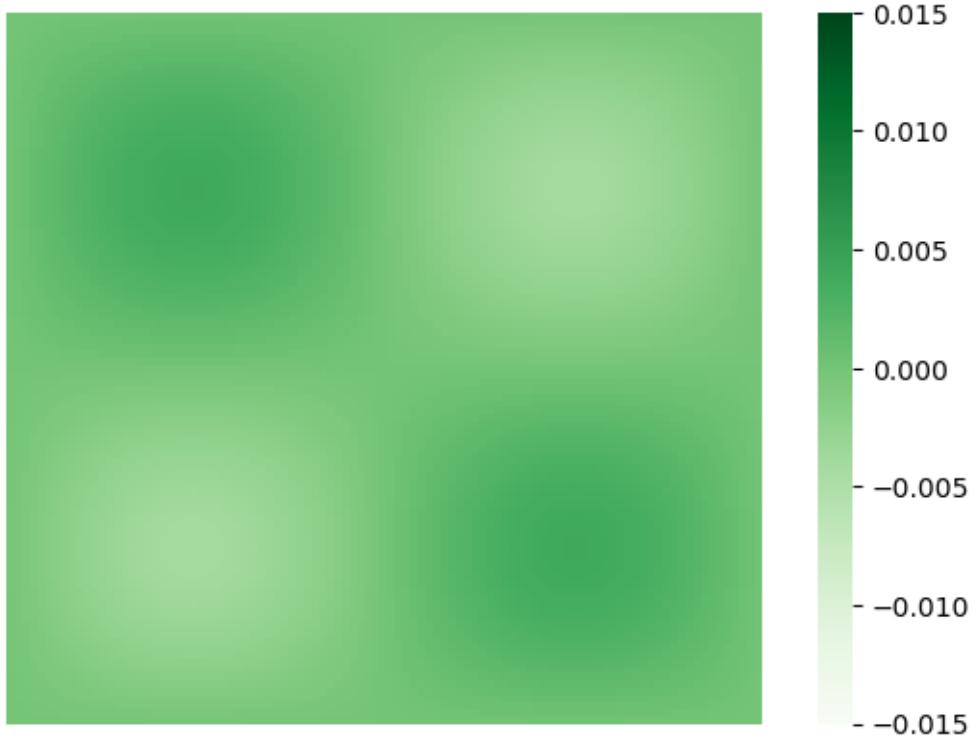
Q_4_Numerical_Solution_at_time_0.460000_.csv

Numerical Solution: Time = 0.46 s



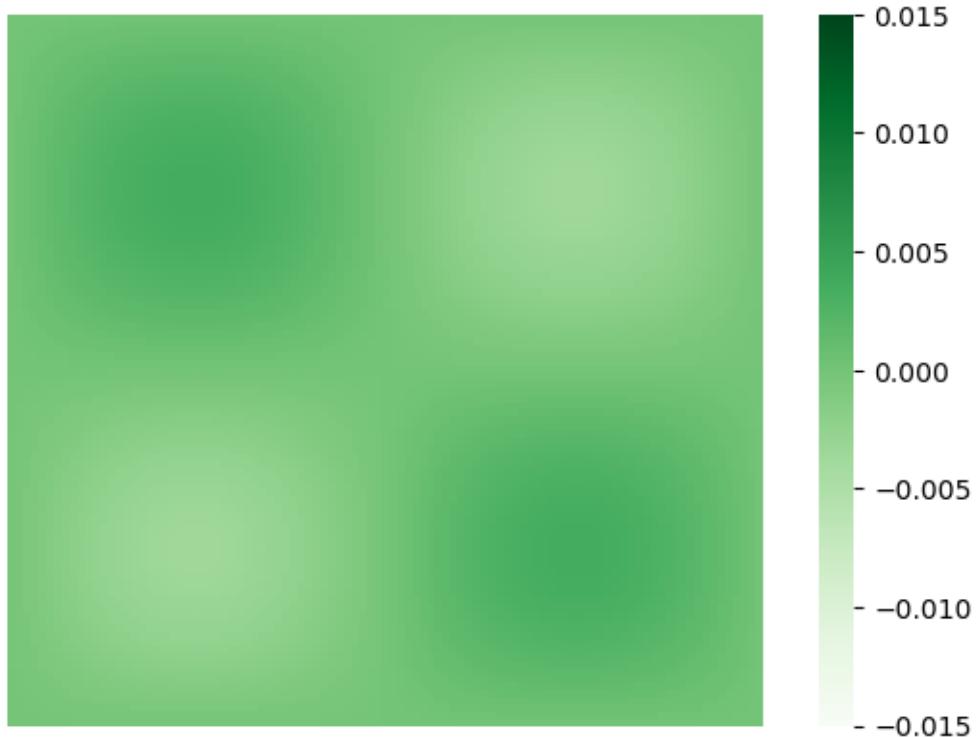
Q_4_Numerical_Solution_at_time_0.465000_.csv

Numerical Solution: Time = 0.465 s



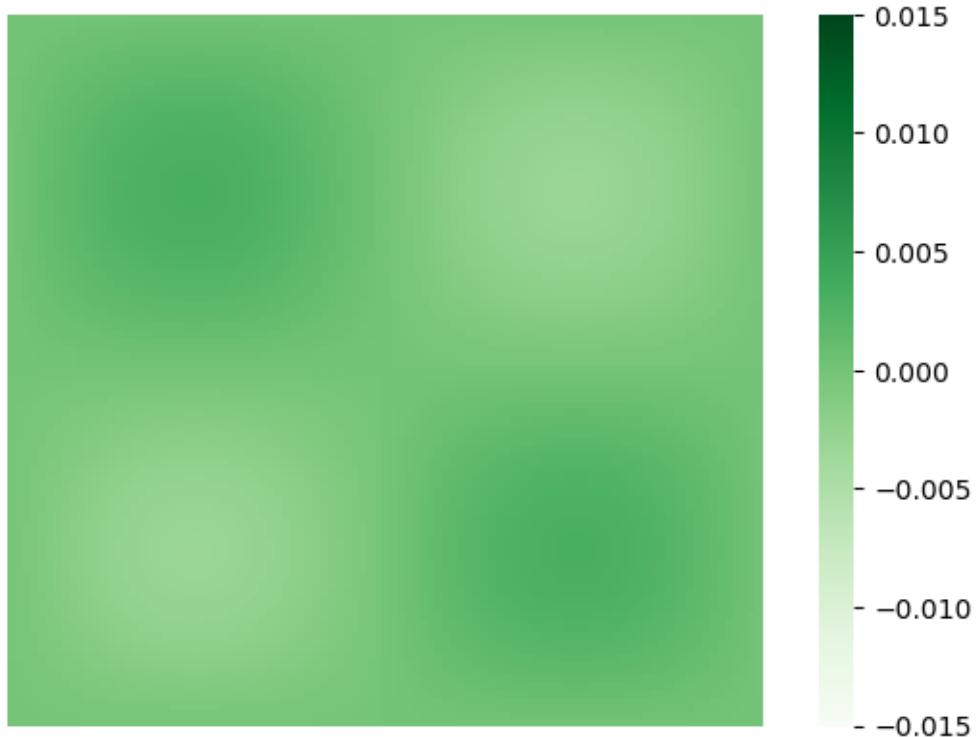
Q_4_Numerical_Solution_at_time_0.470000_.csv

Numerical Solution: Time = 0.4700000000000003 s



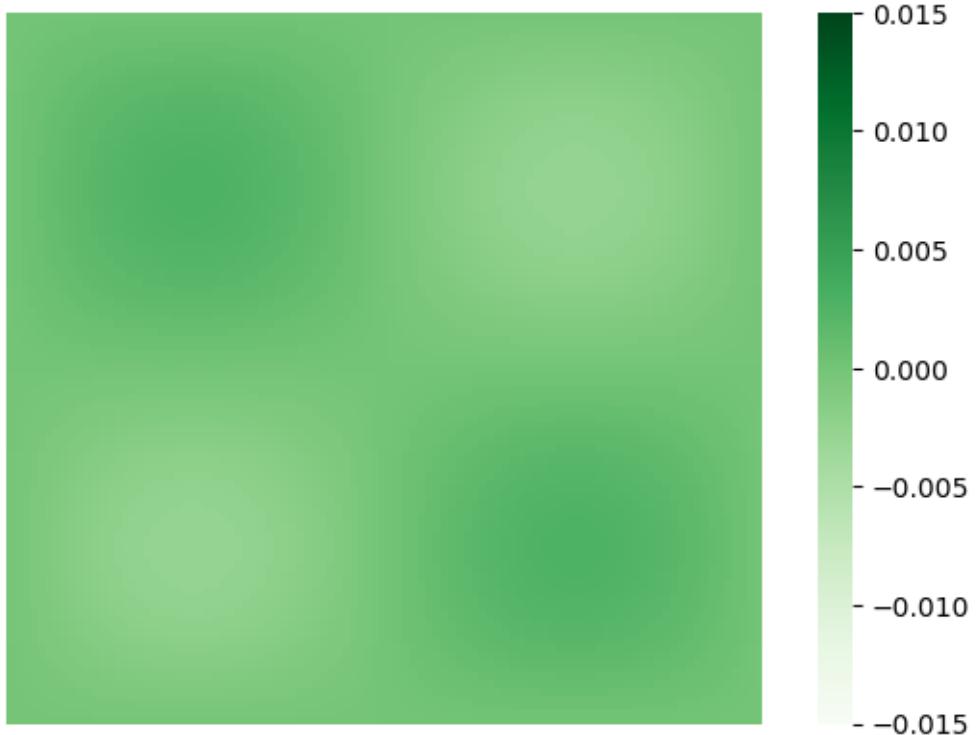
Q_4_Numerical_Solution_at_time_0.475000_.csv

Numerical Solution: Time = 0.4750000000000003 s



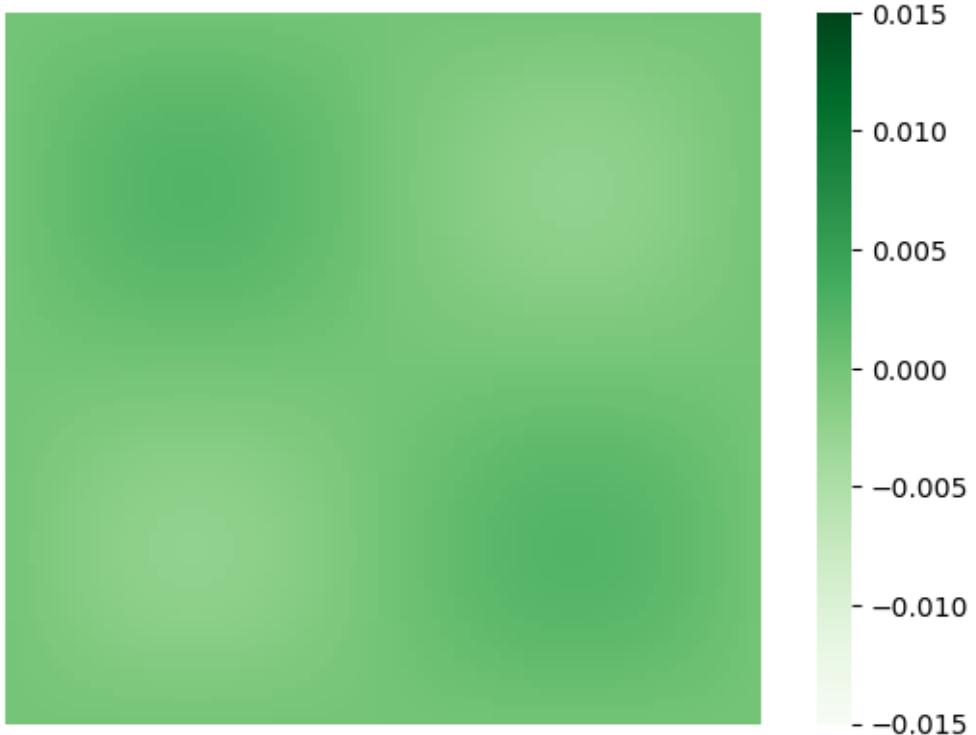
Q_4_Numerical_Solution_at_time_0.480000_.csv

Numerical Solution: Time = 0.48 s



Q_4_Numerical_Solution_at_time_0.485000_.csv

Numerical Solution: Time = 0.485 s



Q_4_Numerical_Solution_at_time_0.490000_.csv

Numerical Solution: Time = 0.49 s



Q_4_Numerical_Solution_at_time_0.495000_.csv

Numerical Solution: Time = 0.495 s



Q_4_Numerical_Solution_at_time_0.500000_.csv

Numerical Solution: Time = 0.5 s



Q_4_Numerical_Solution_at_time_0.505000_.csv

Numerical Solution: Time = 0.505 s



Q_4_Numerical_Solution_at_time_0.510000_.csv

Numerical Solution: Time = 0.51 s



Q_4_Numerical_Solution_at_time_0.515000_.csv

Numerical Solution: Time = 0.515 s



Q_4_Numerical_Solution_at_time_0.520000_.csv

Numerical Solution: Time = 0.52 s



Q_4_Numerical_Solution_at_time_0.525000_.csv

Numerical Solution: Time = 0.525 s



Q_4_Numerical_Solution_at_time_0.530000_.csv

Numerical Solution: Time = 0.53 s



Q_4_Numerical_Solution_at_time_0.535000_.csv

Numerical Solution: Time = 0.535 s



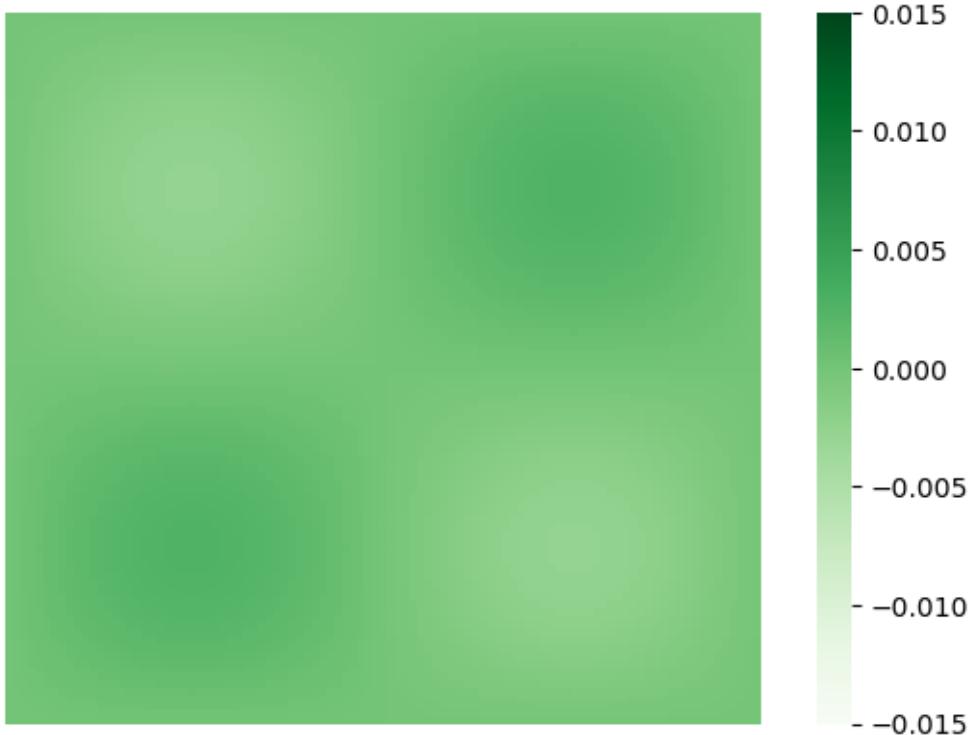
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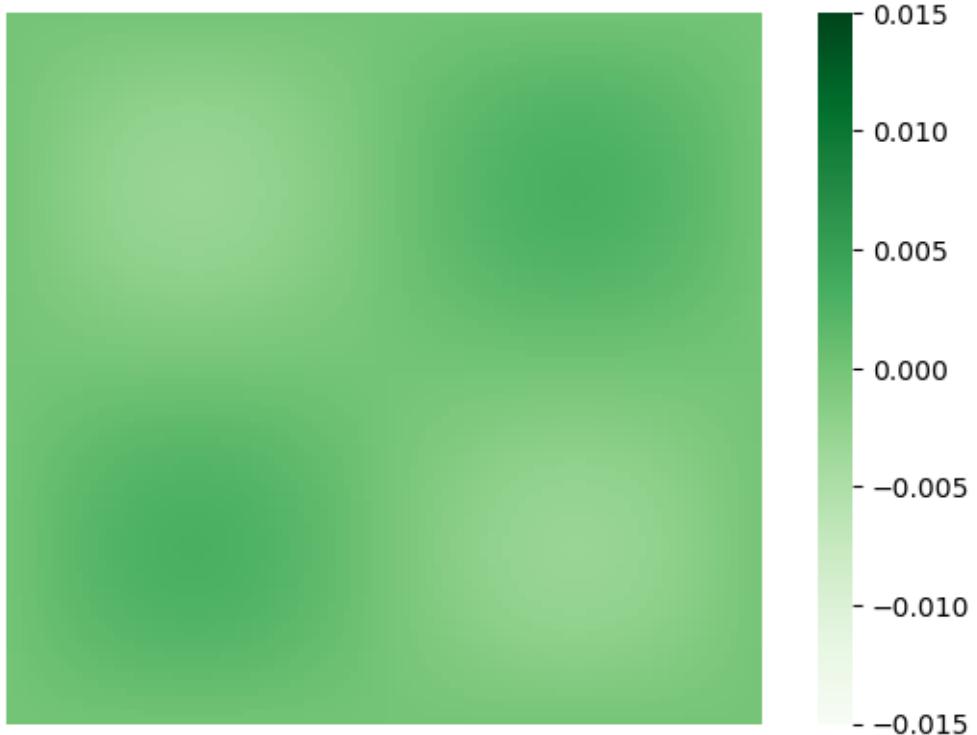
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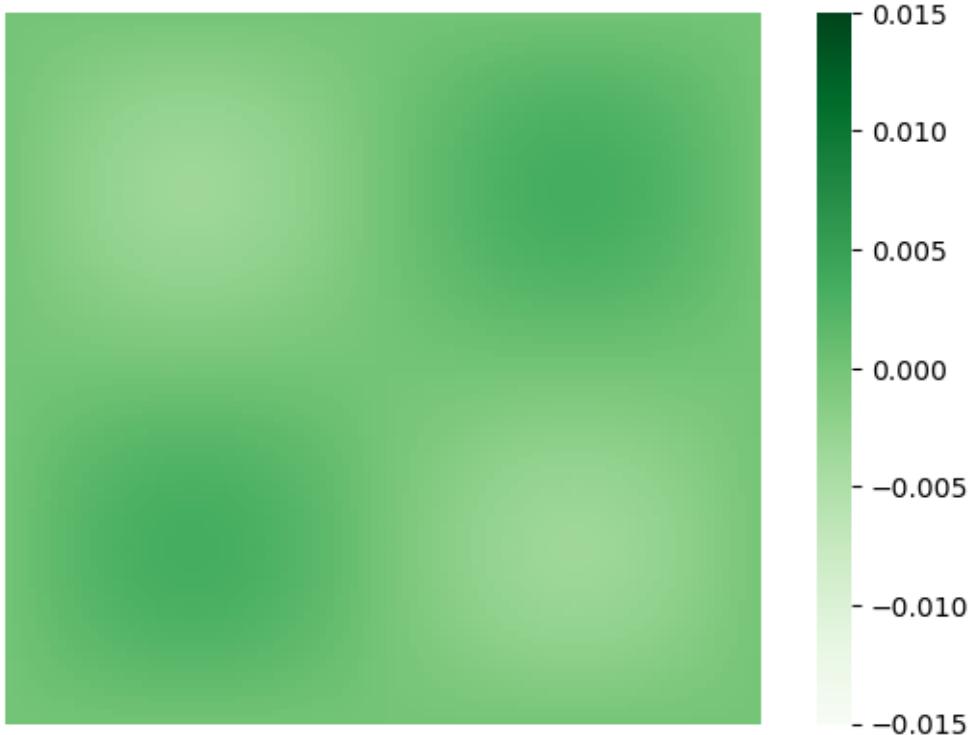
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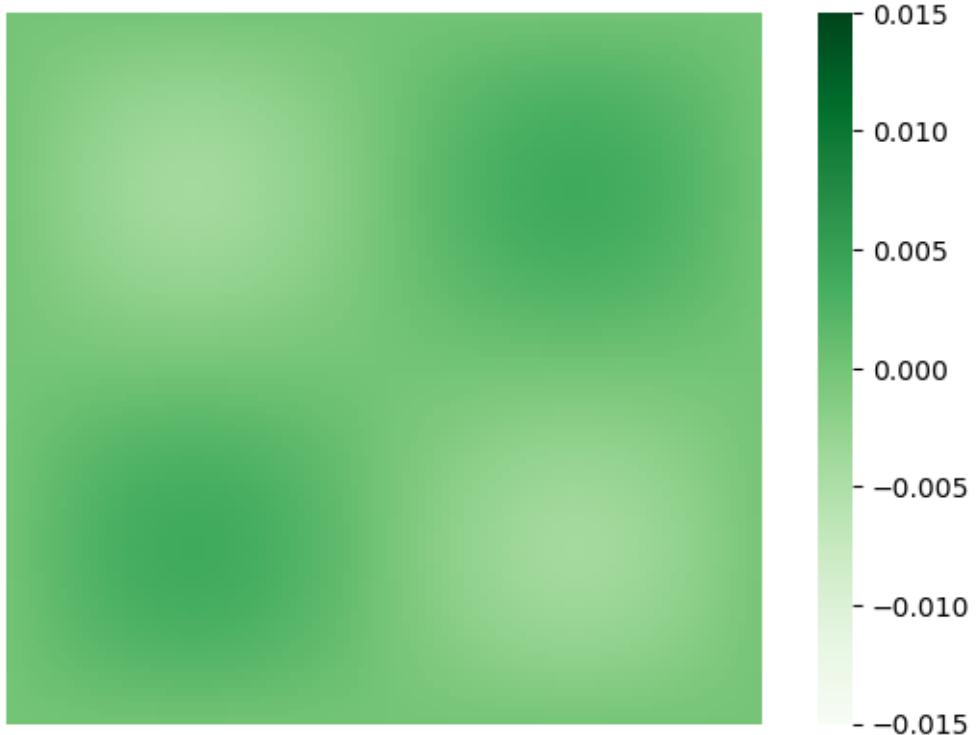
Q_4_Numerical_Solution_at_time_0.555000_.csv

Numerical Solution: Time = 0.555 s



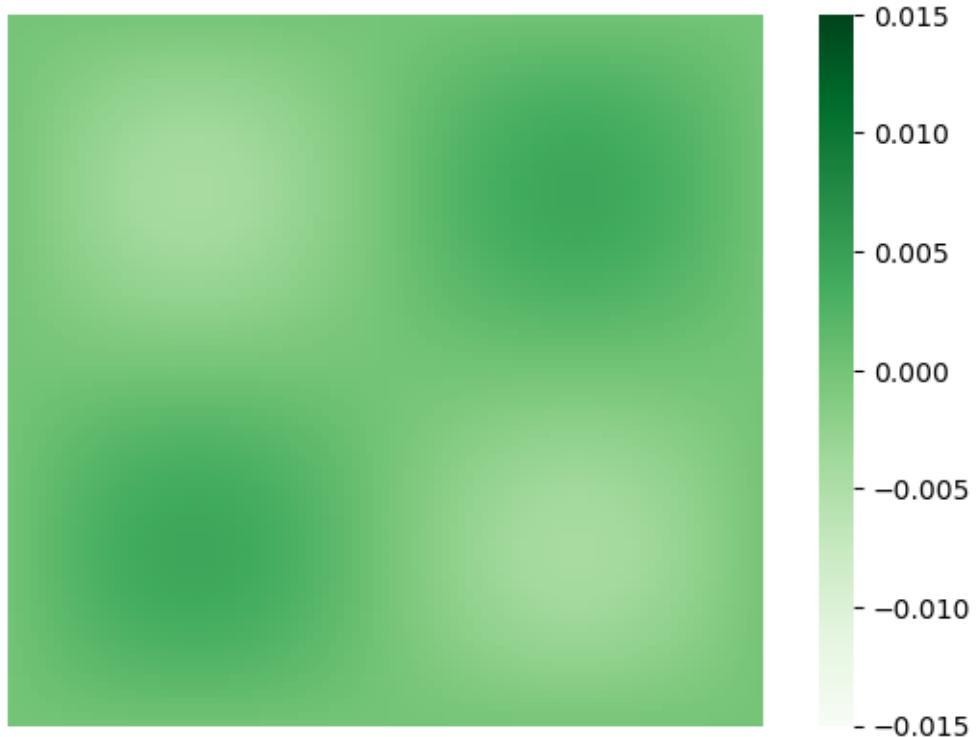
Q_4_Numerical_Solution_at_time_0.560000_.csv

Numerical Solution: Time = 0.56 s



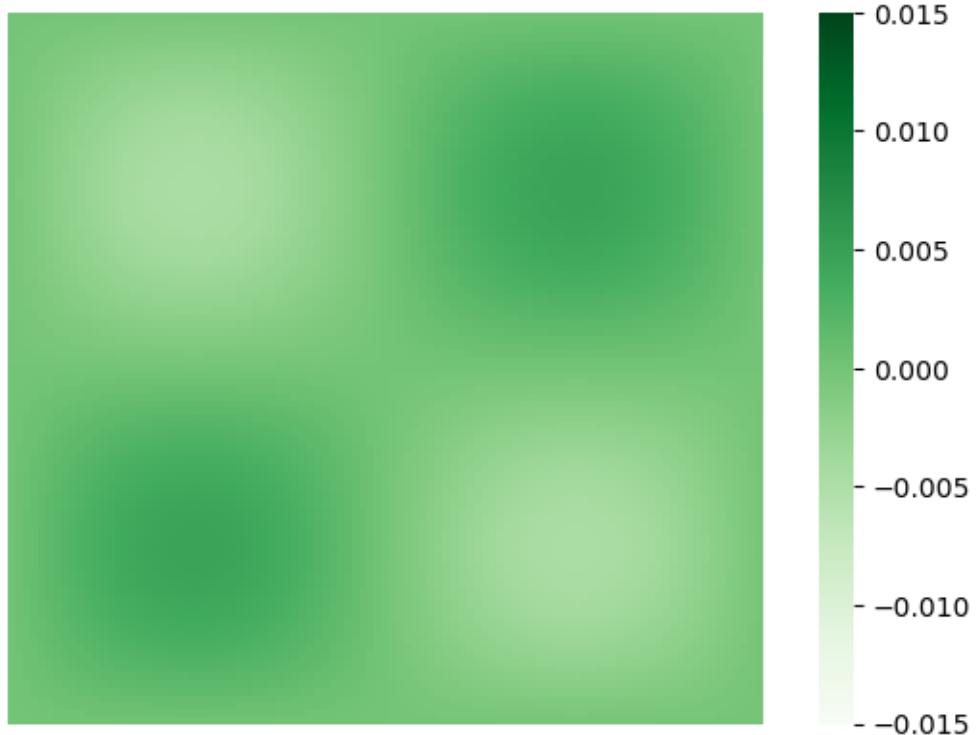
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Numerical Solution: Time = 0.5650000000000001 s



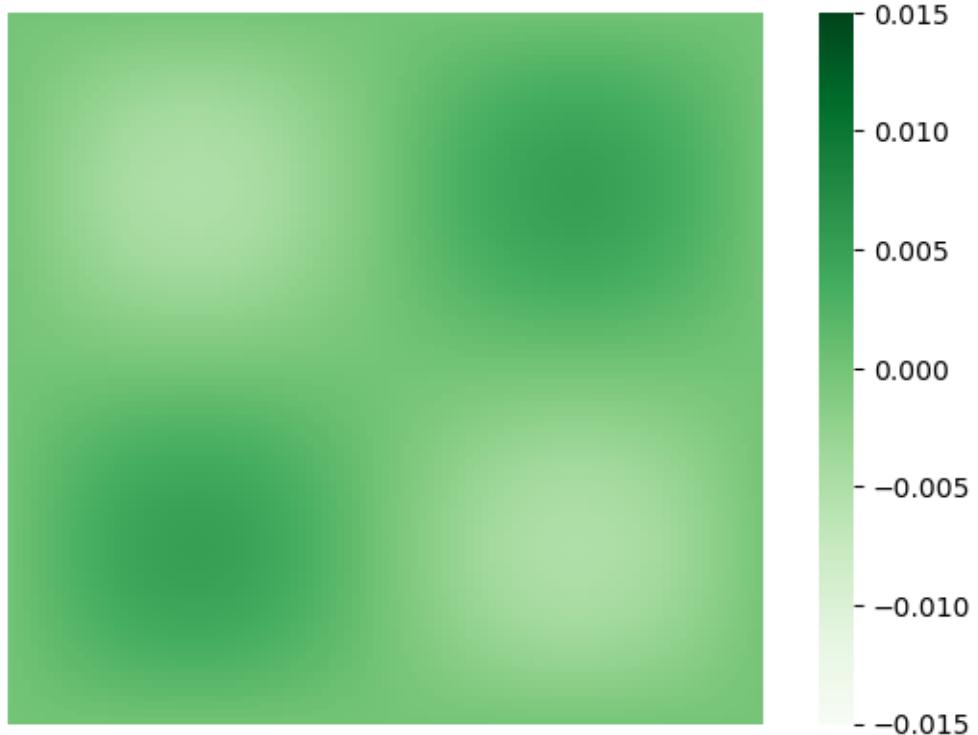
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Numerical Solution: Time = 0.5700000000000001 s



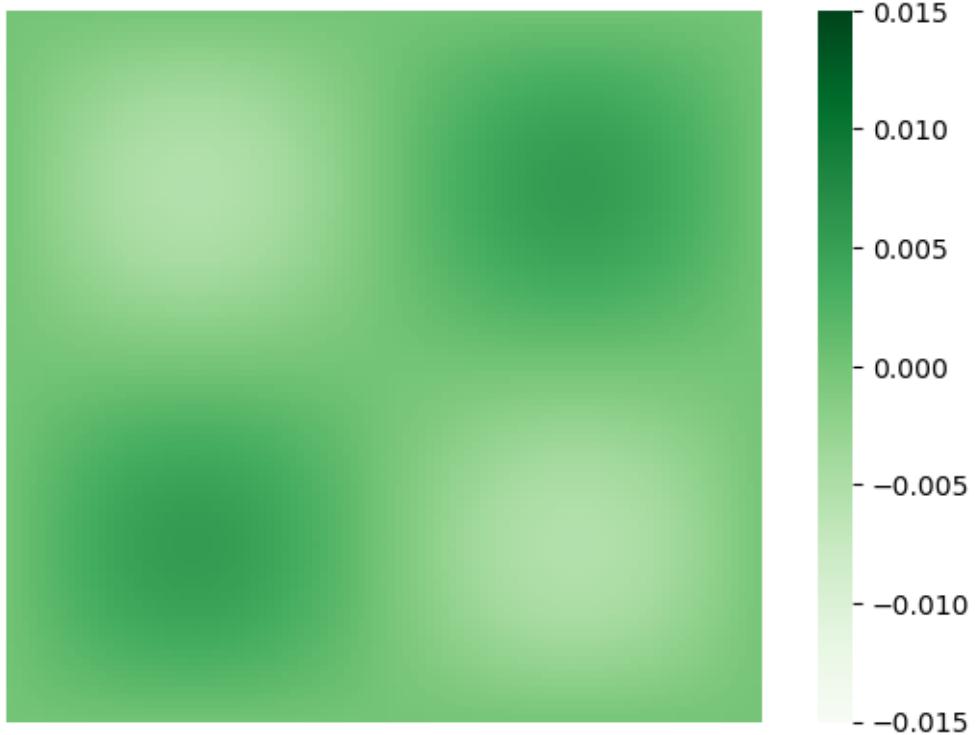
Q_4_Numerical_Solution_at_time_0.575000_.csv

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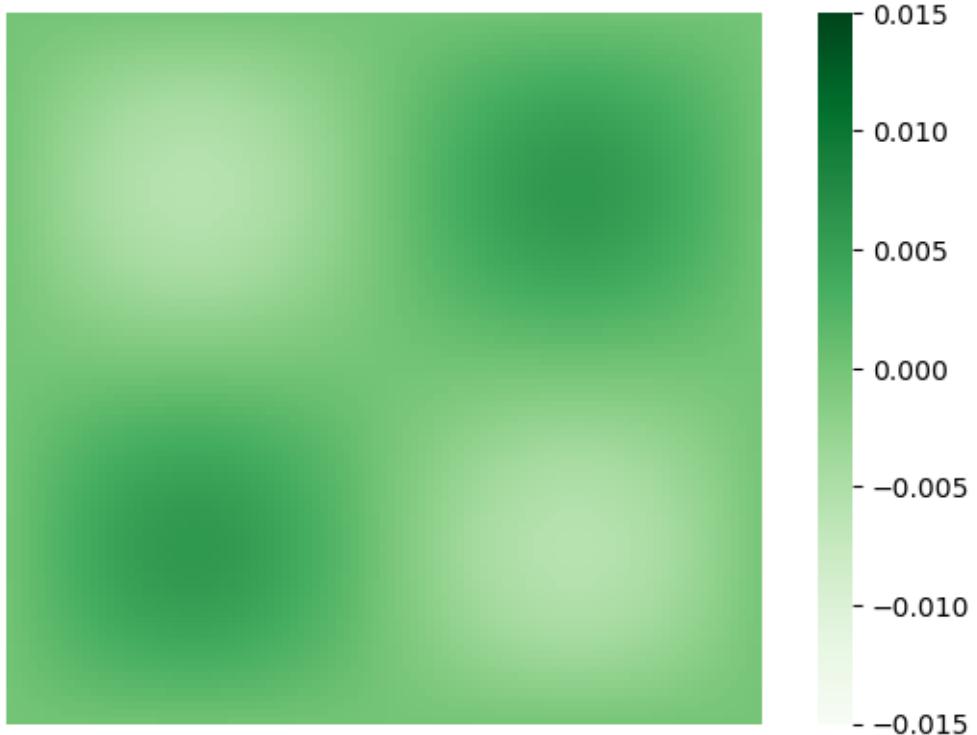
Q_4_Numerical_Solution_at_time_0.580000_.csv

Numerical Solution: Time = 0.58 s



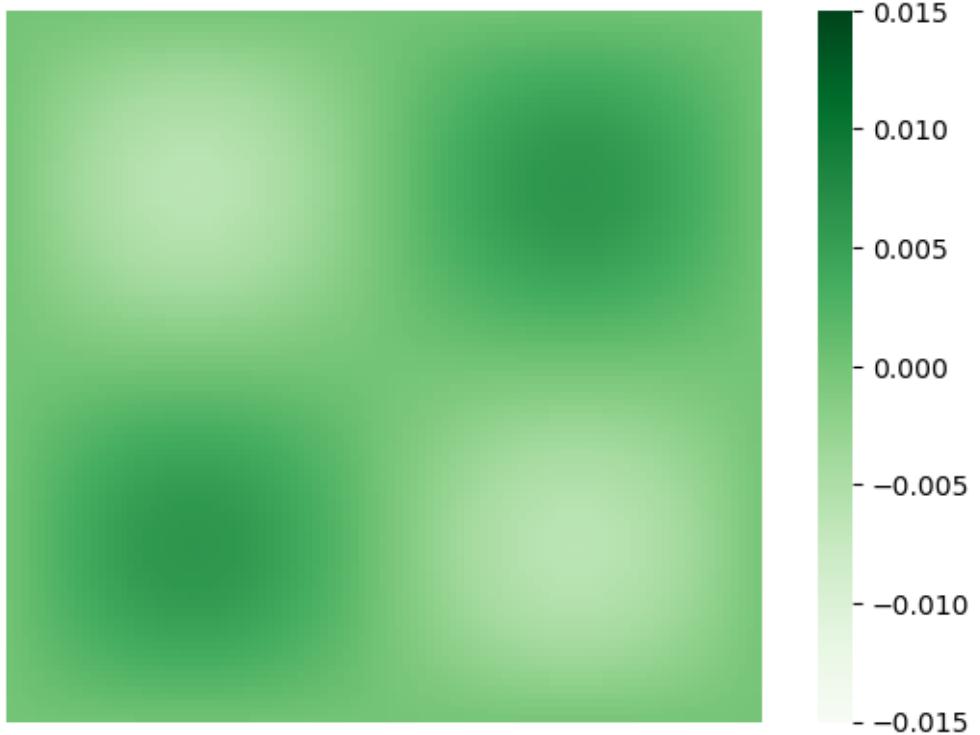
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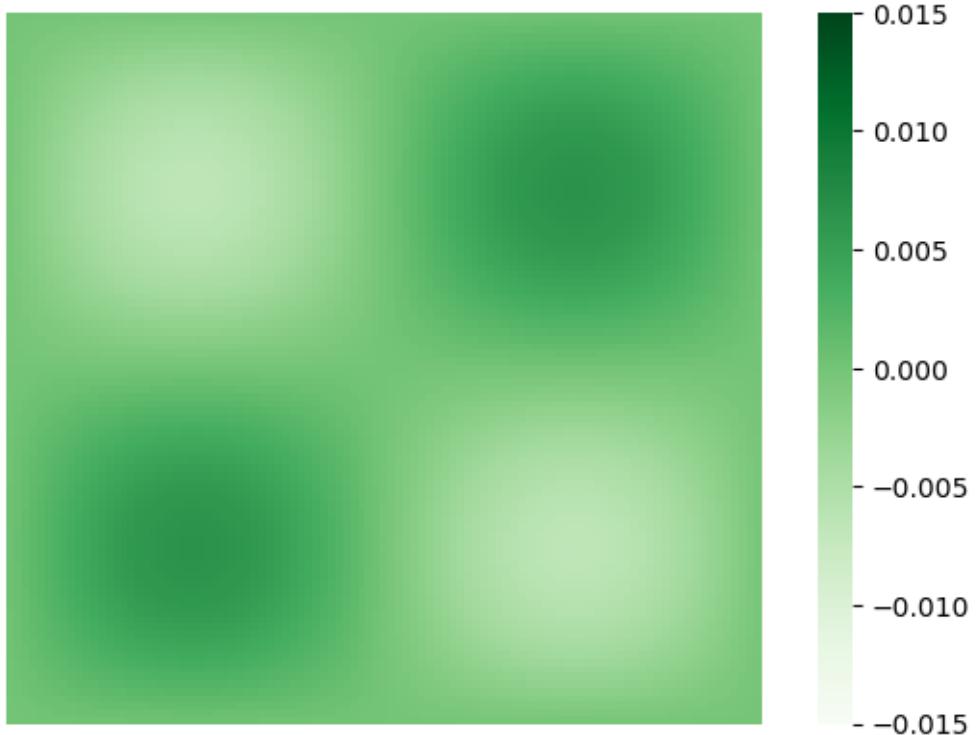
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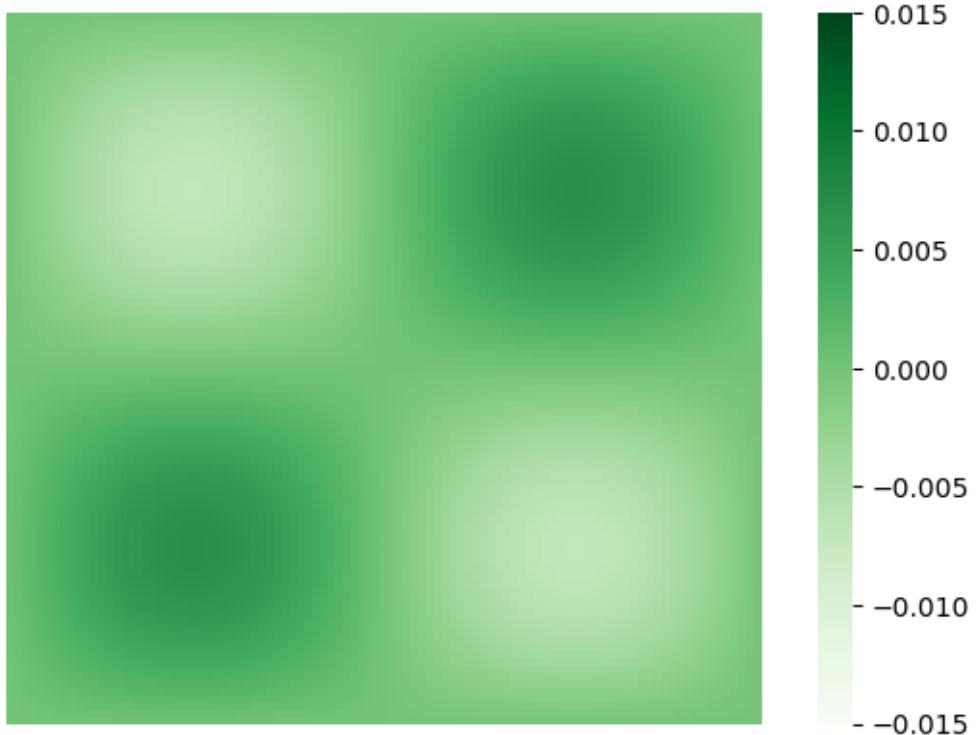
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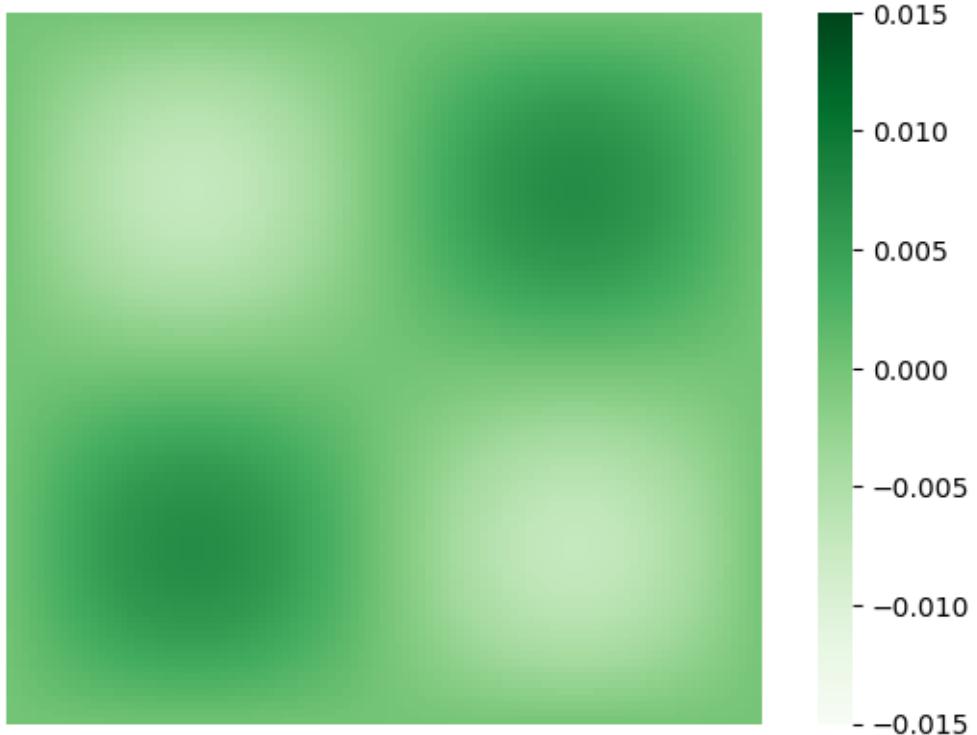
Q_4_Numerical_Solution_at_time_0.600000_.csv

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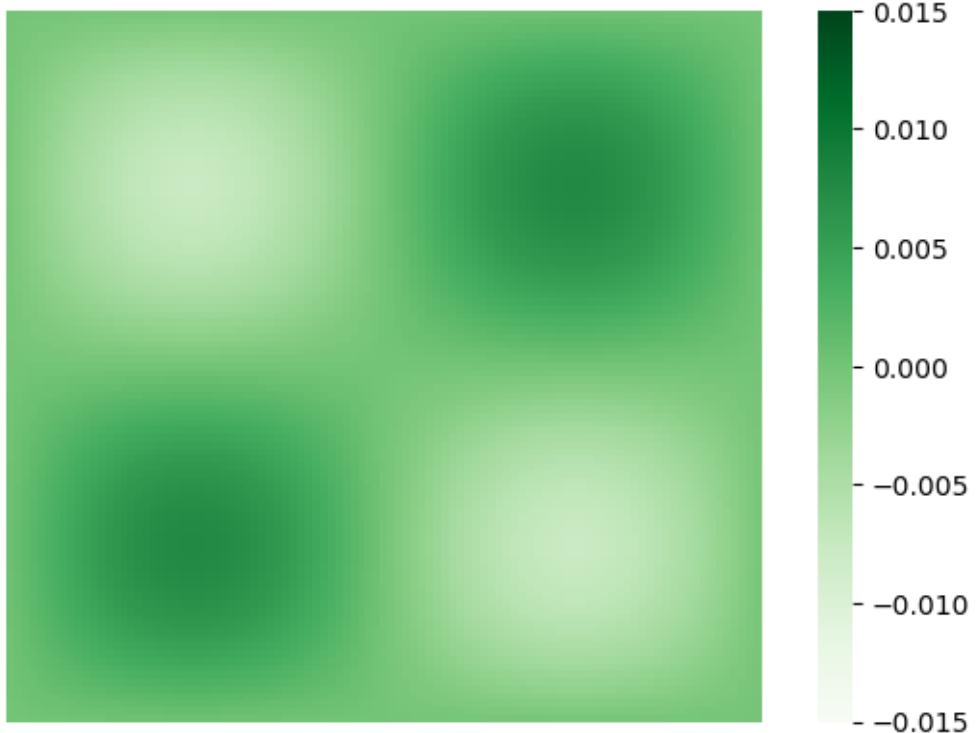
Q_4_Numerical_Solution_at_time_0.605000_.csv

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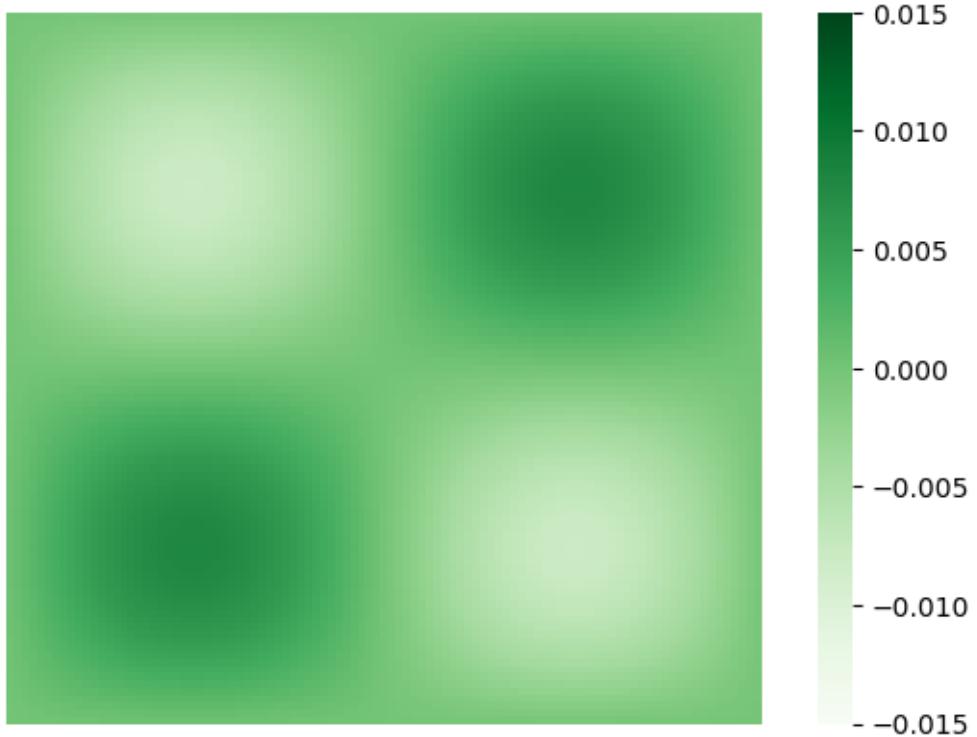
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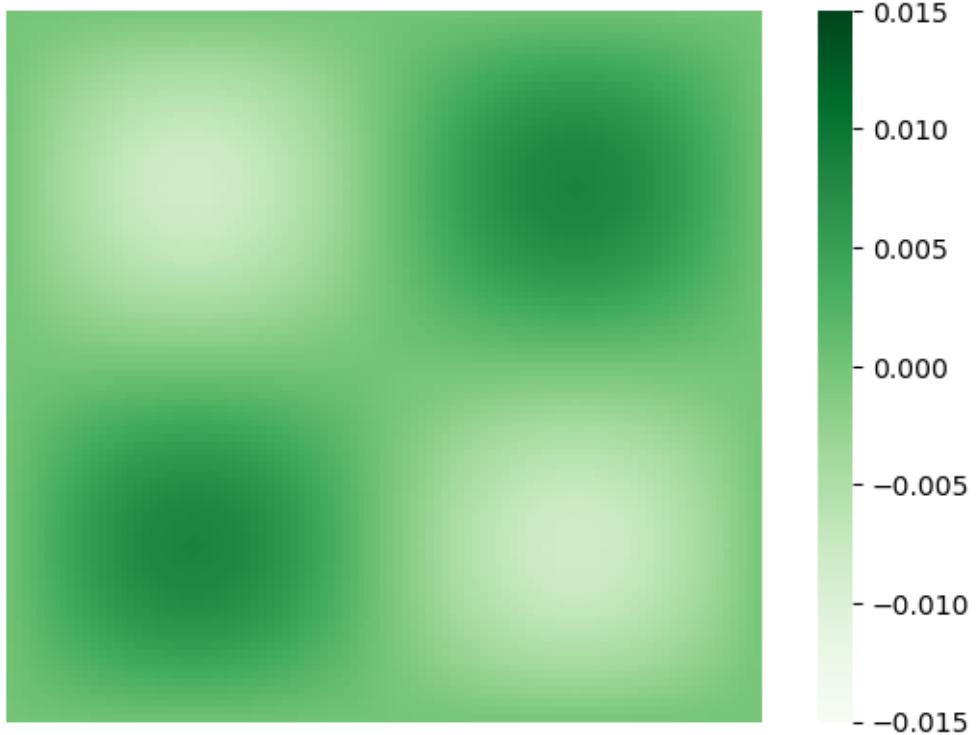
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Numerical Solution: Time = 0.615 s



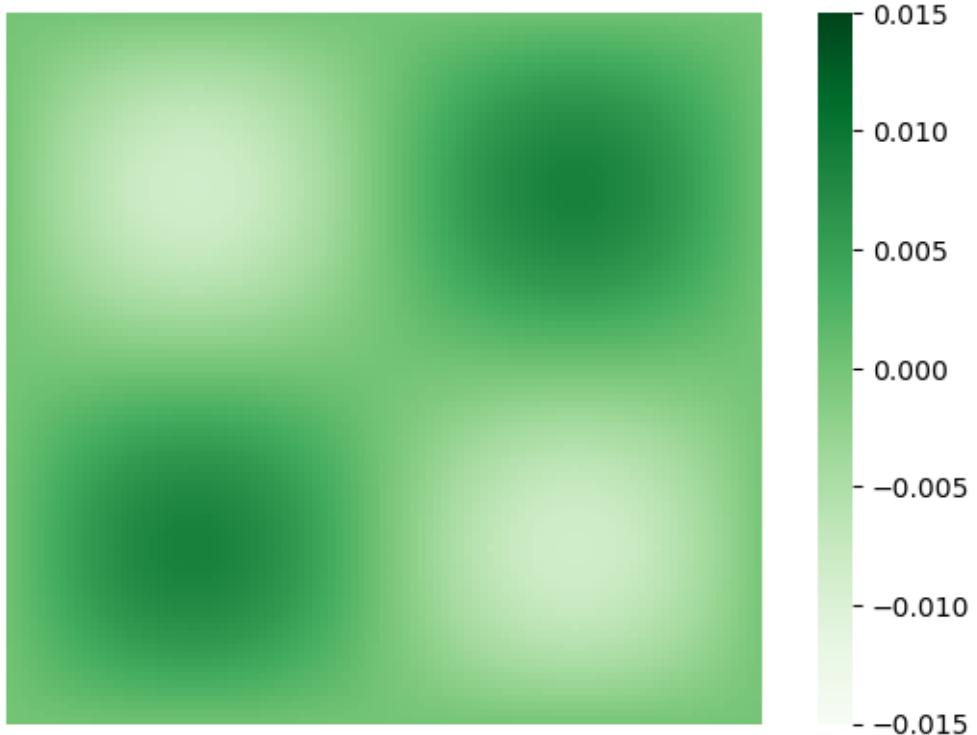
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Numerical Solution: Time = 0.62 s



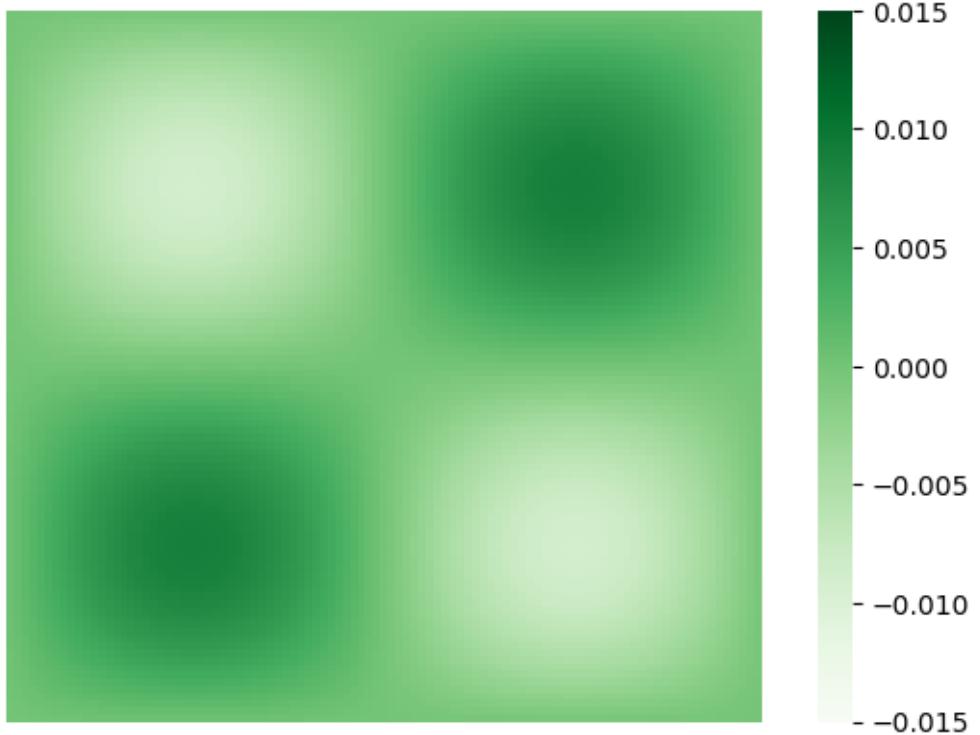
Q_4_Numerical_Solution_at_time_0.625000_.csv

Numerical Solution: Time = 0.625 s



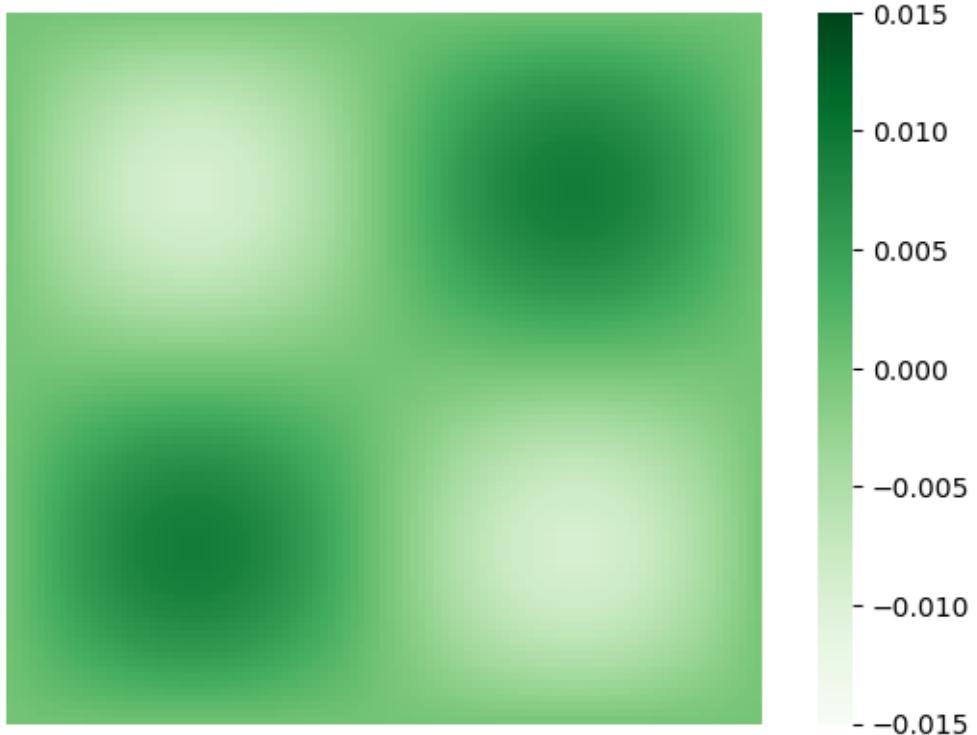
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Numerical Solution: Time = 0.63 s



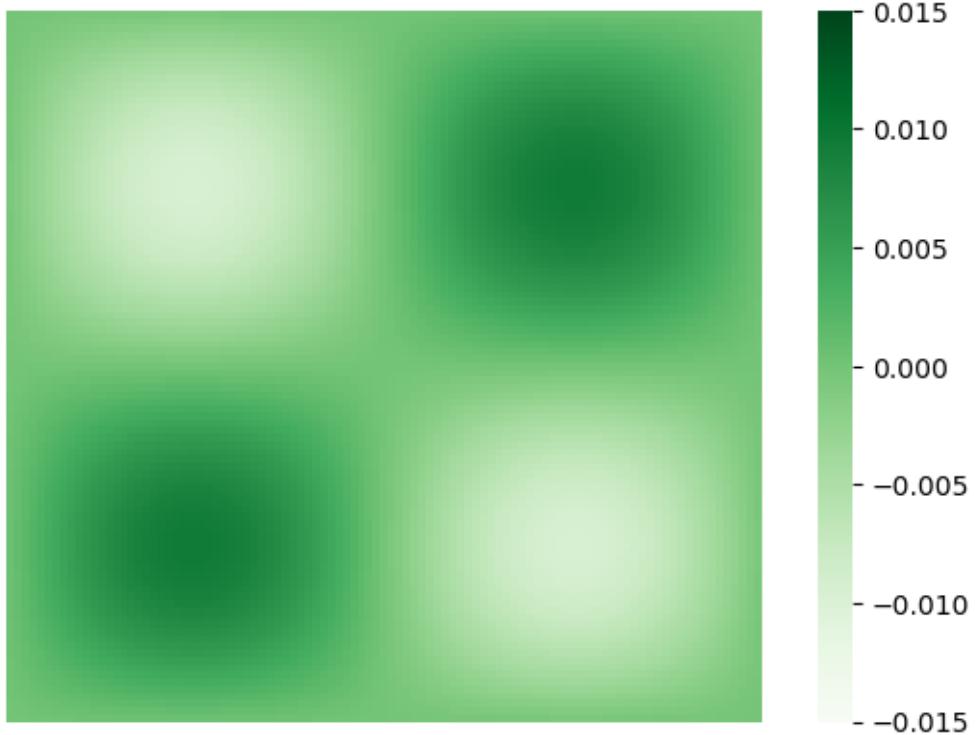
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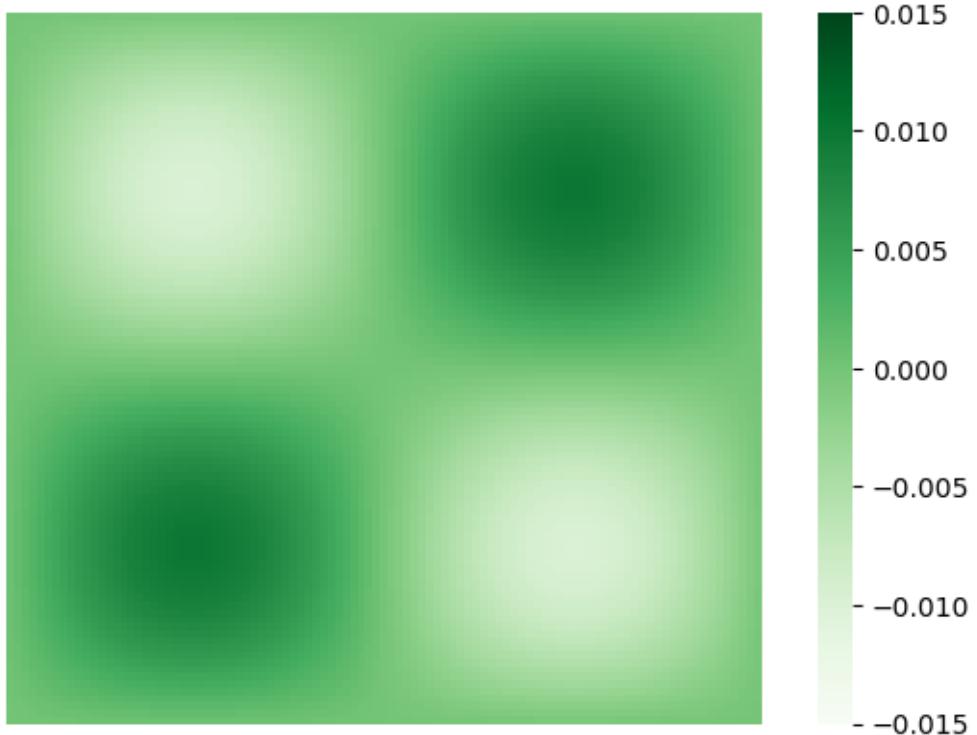
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Numerical Solution: Time = 0.64 s



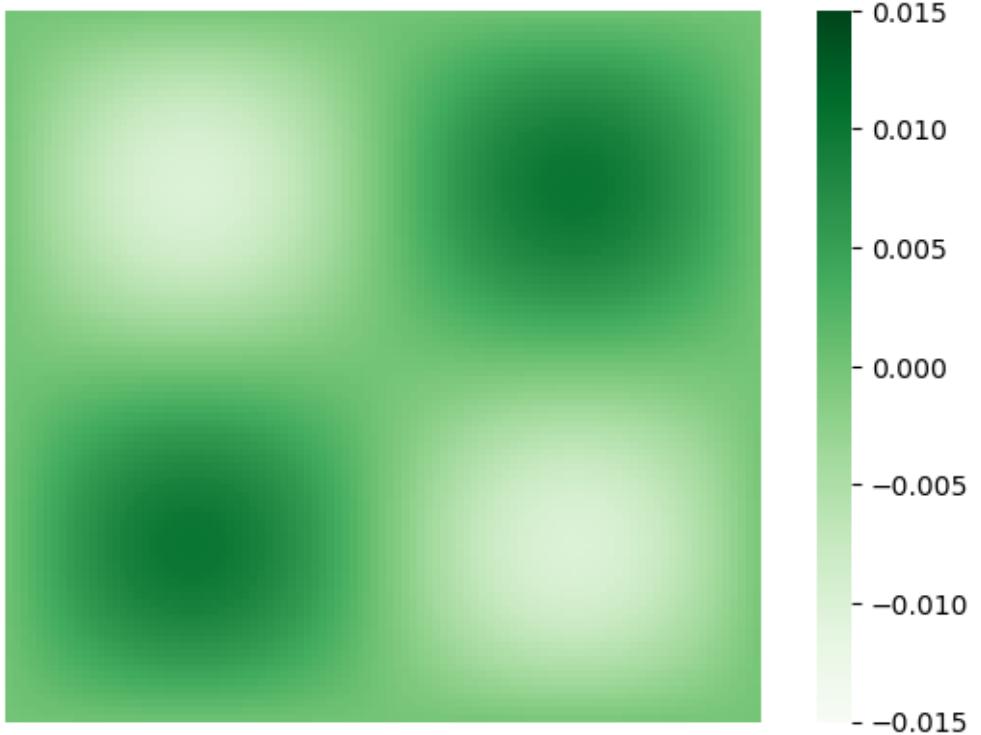
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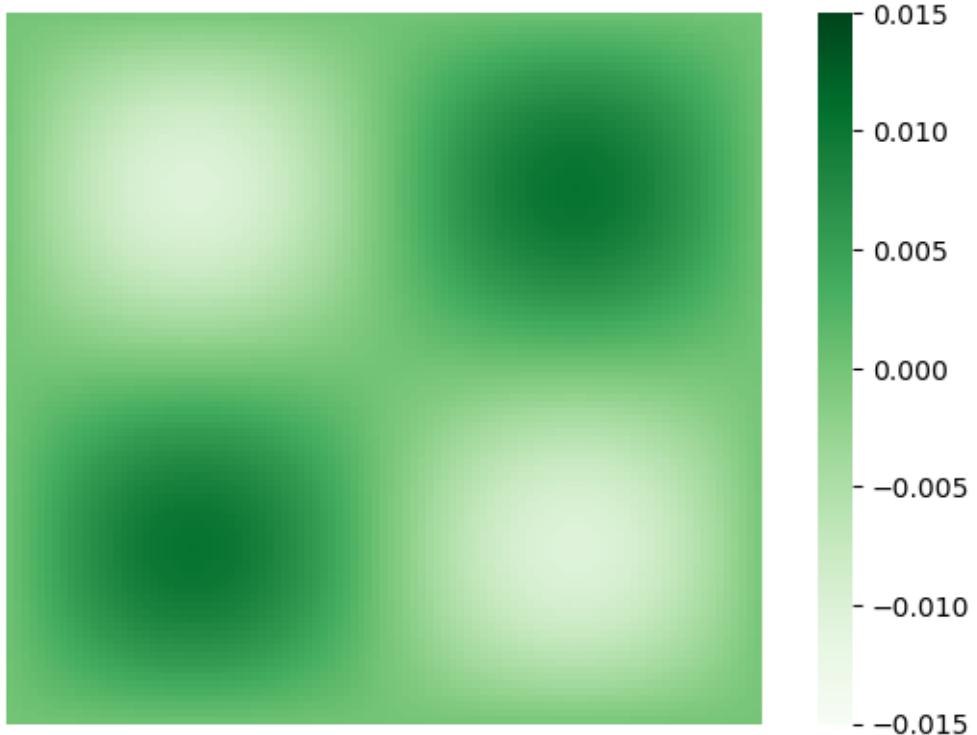
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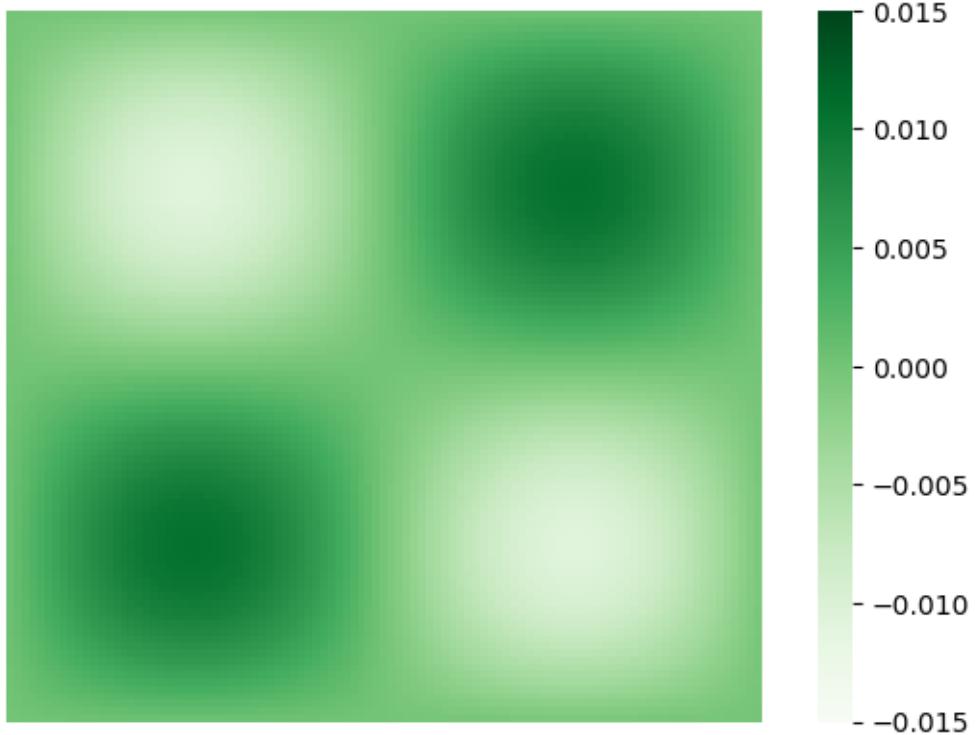
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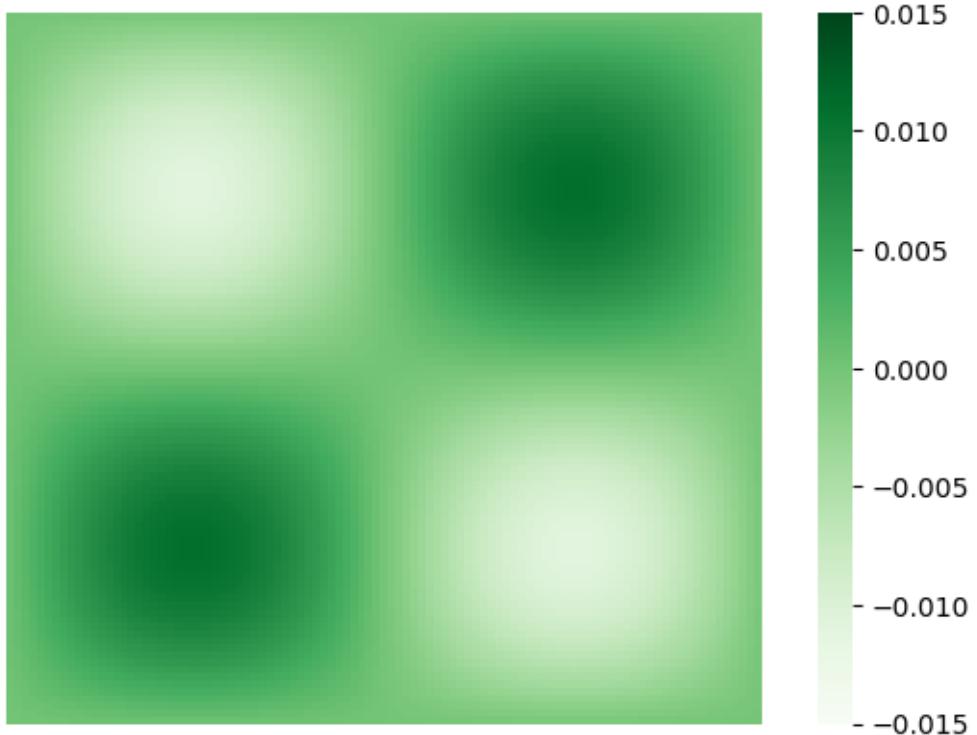
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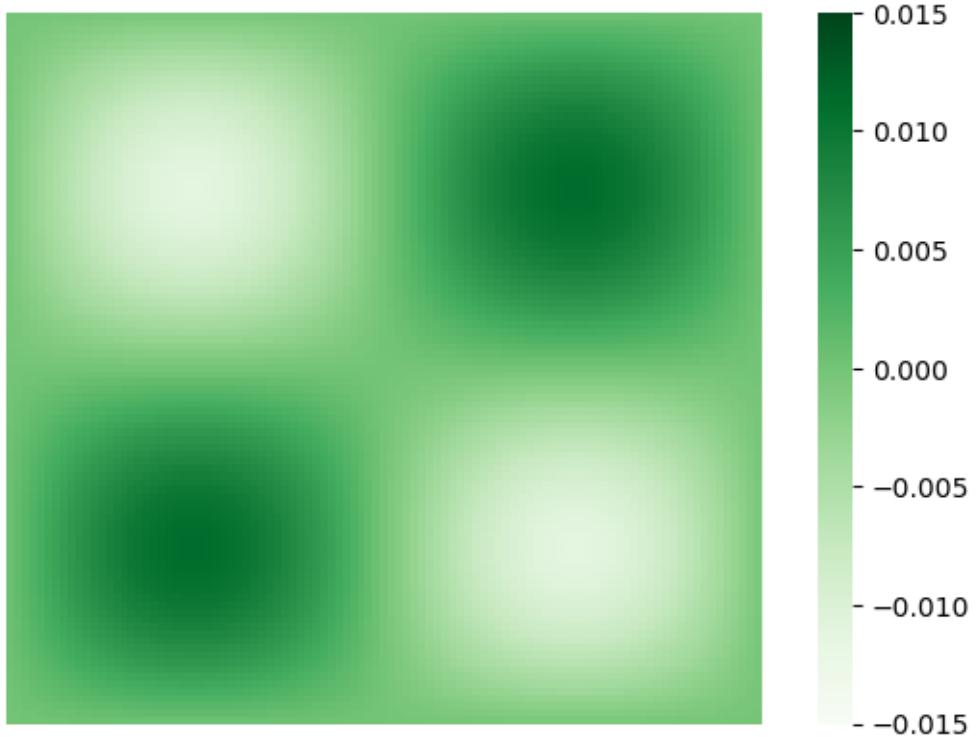
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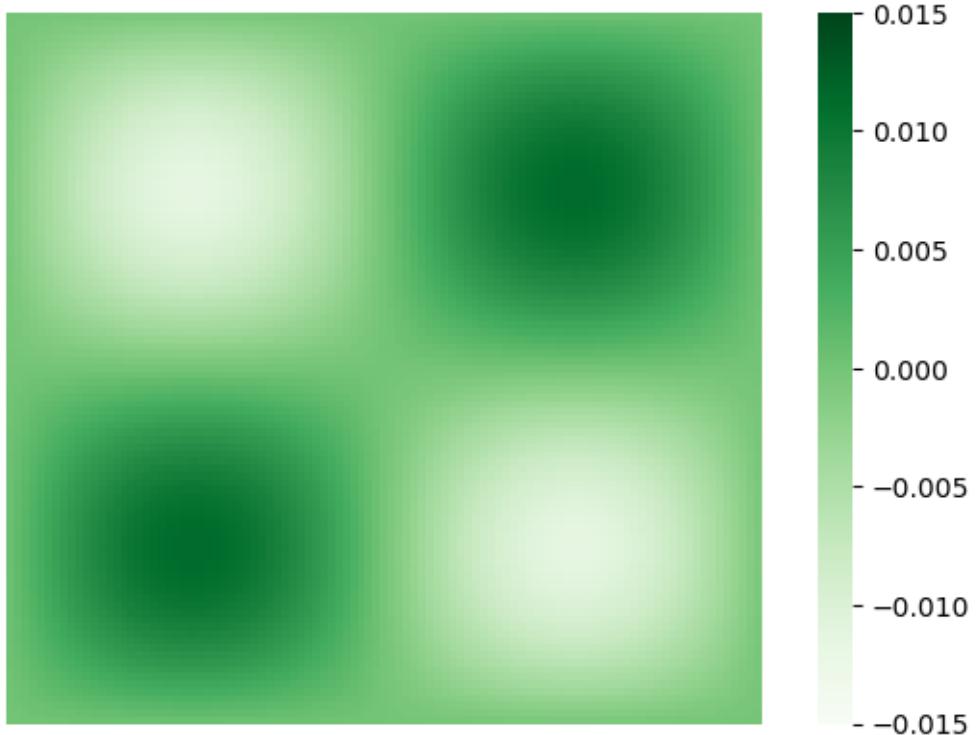
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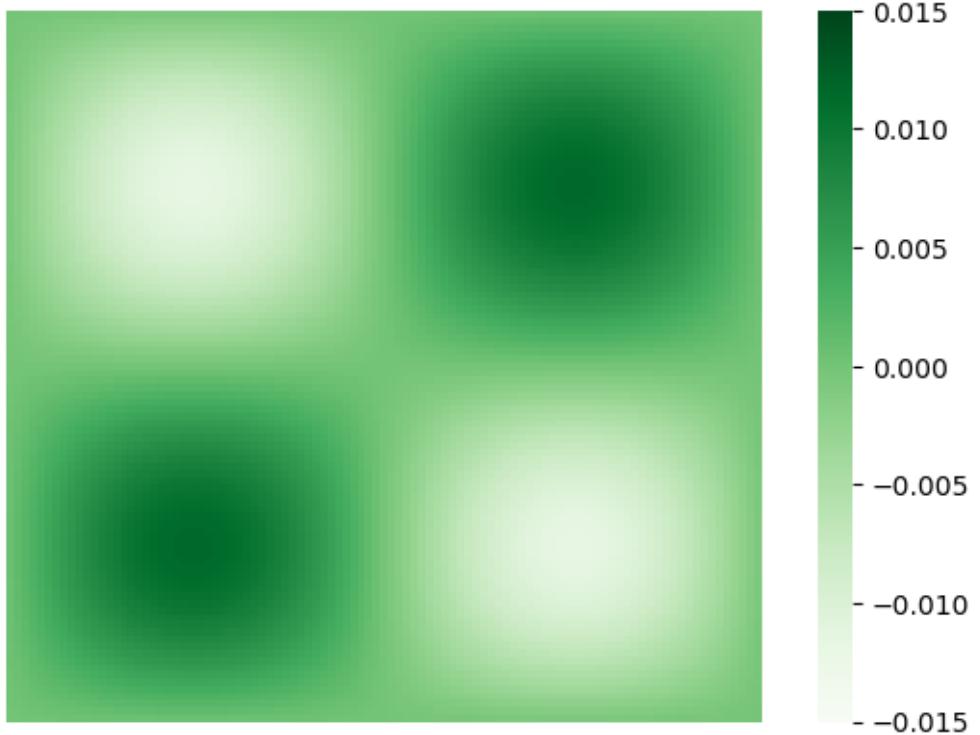
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Numerical Solution: Time = 0.675 s



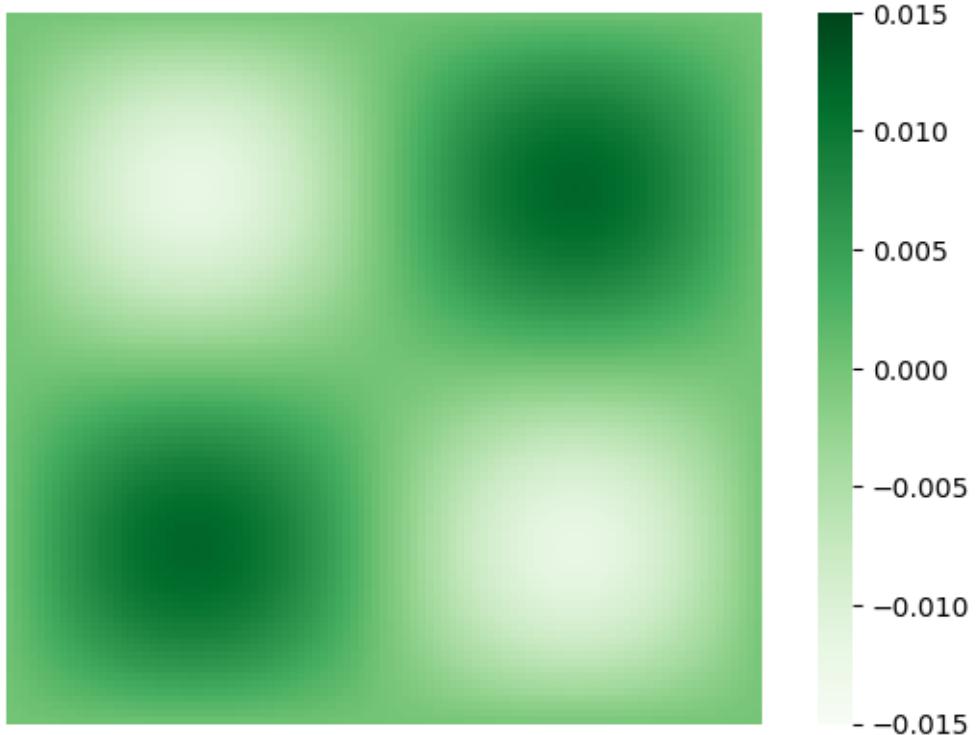
Q_4_Numerical_Solution_at_time_0.680000_.csv

Numerical Solution: Time = 0.68 s



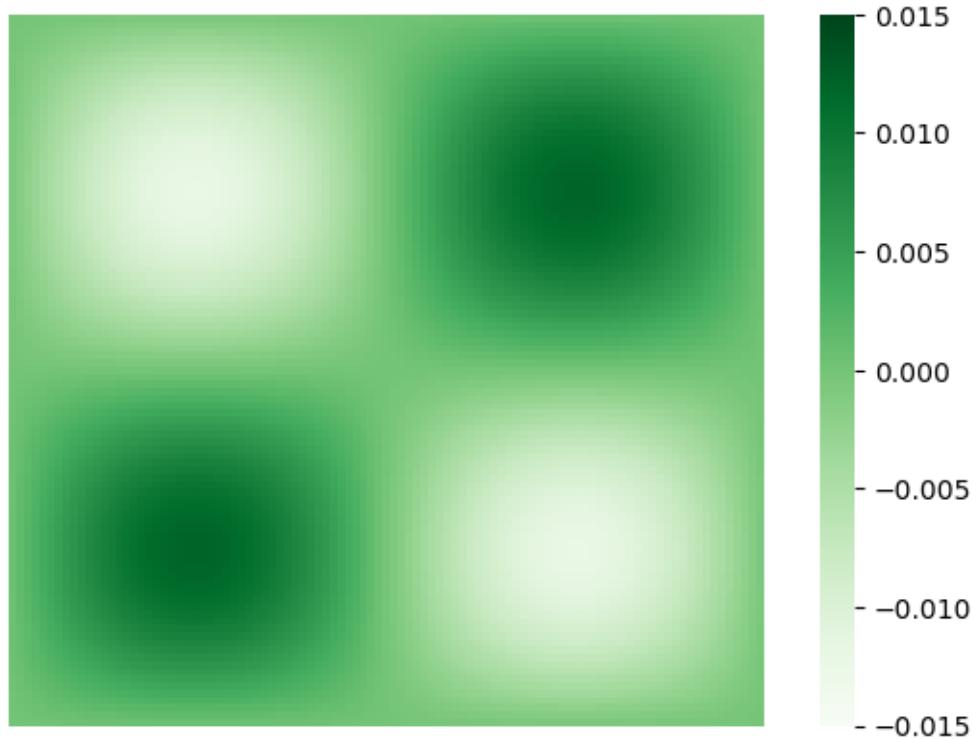
Q_4_Numerical_Solution_at_time_0.685000_.csv

Numerical Solution: Time = 0.685 s



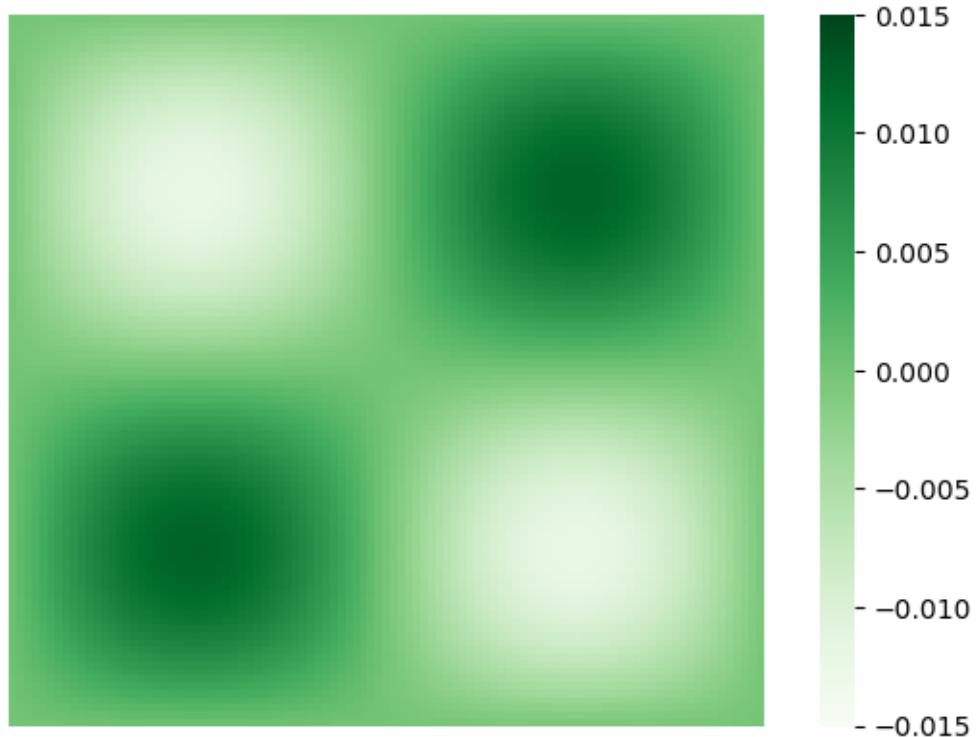
Q_4_Numerical_Solution_at_time_0.690000_.csv

Numerical Solution: Time = 0.6900000000000001 s



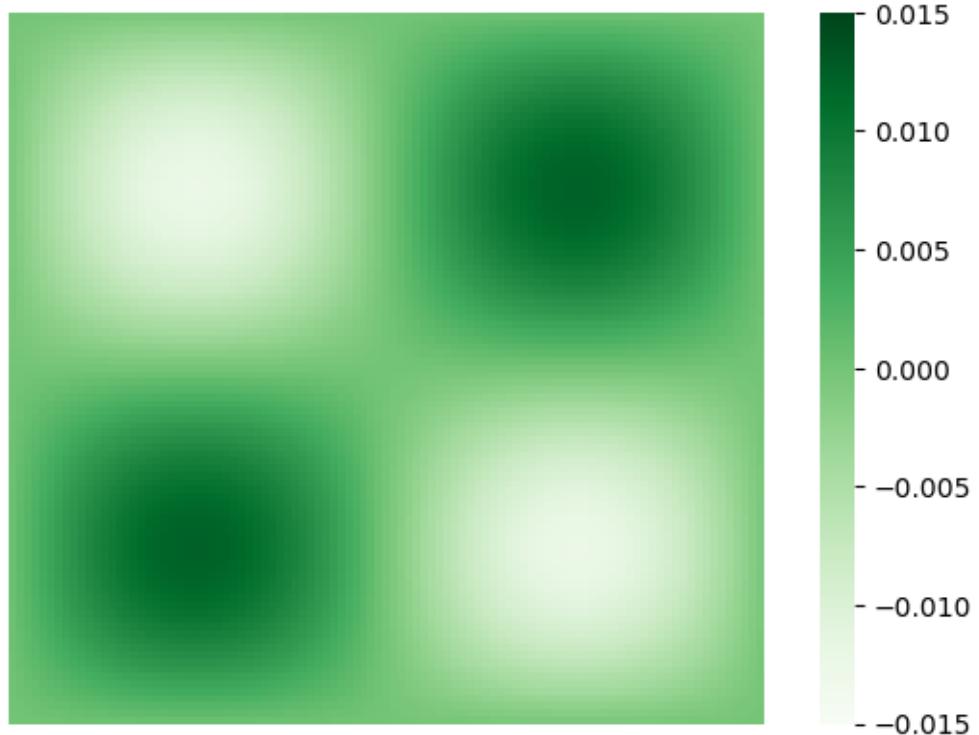
Q_4_Numerical_Solution_at_time_0.695000_.csv

Numerical Solution: Time = 0.6950000000000001 s



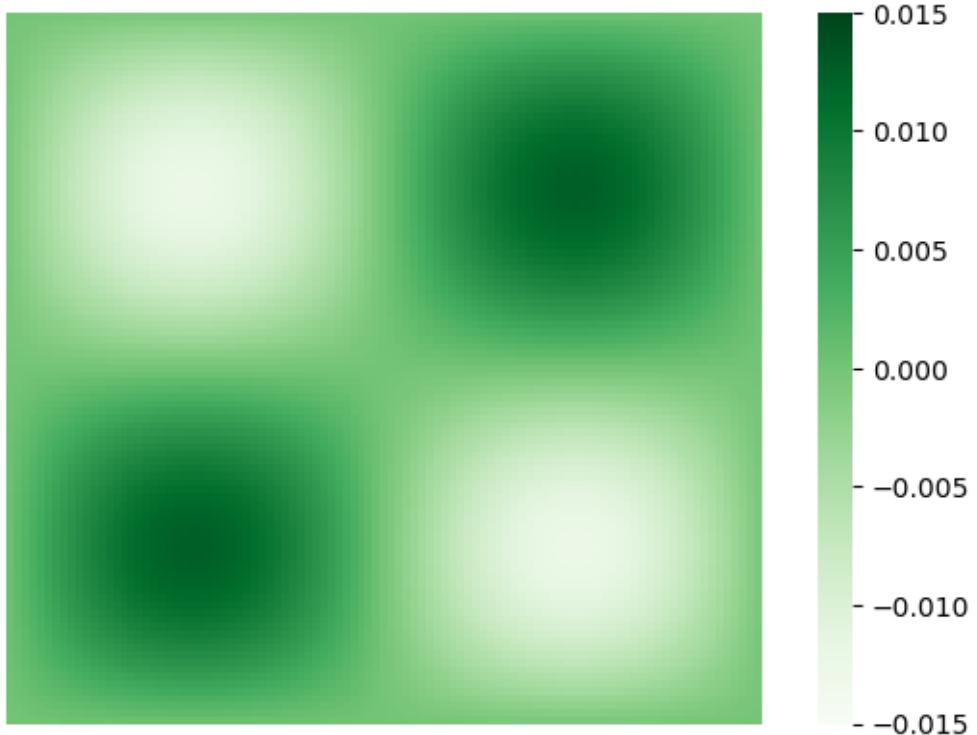
Q_4_Numerical_Solution_at_time_0.700000_.csv

Numerical Solution: Time = 0.7000000000000001 s



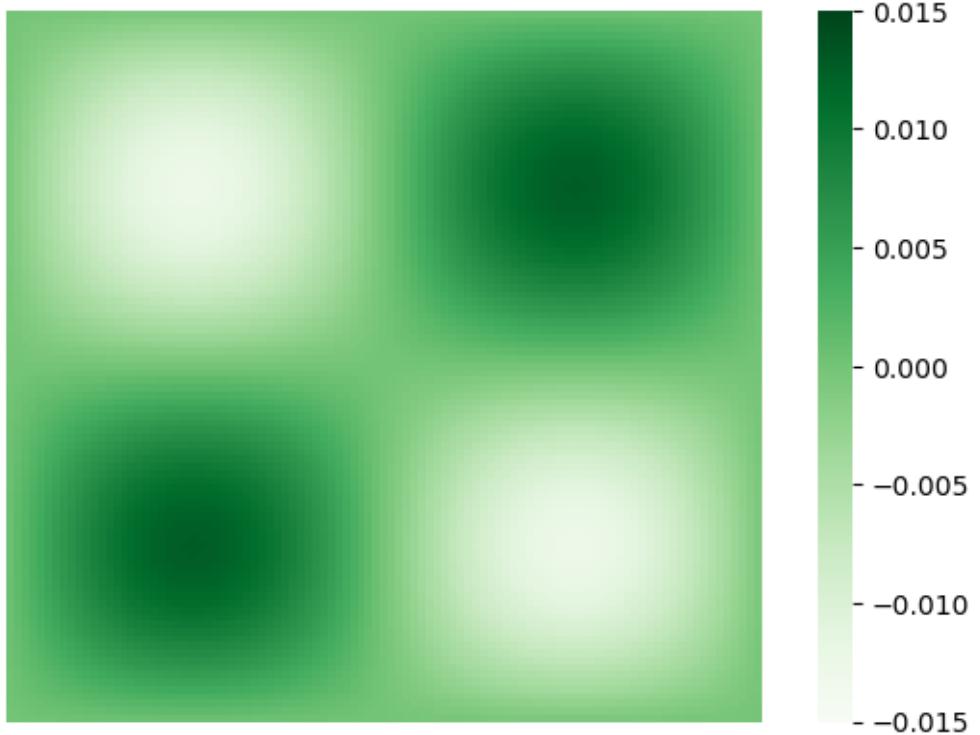
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Numerical Solution: Time = 0.705 s



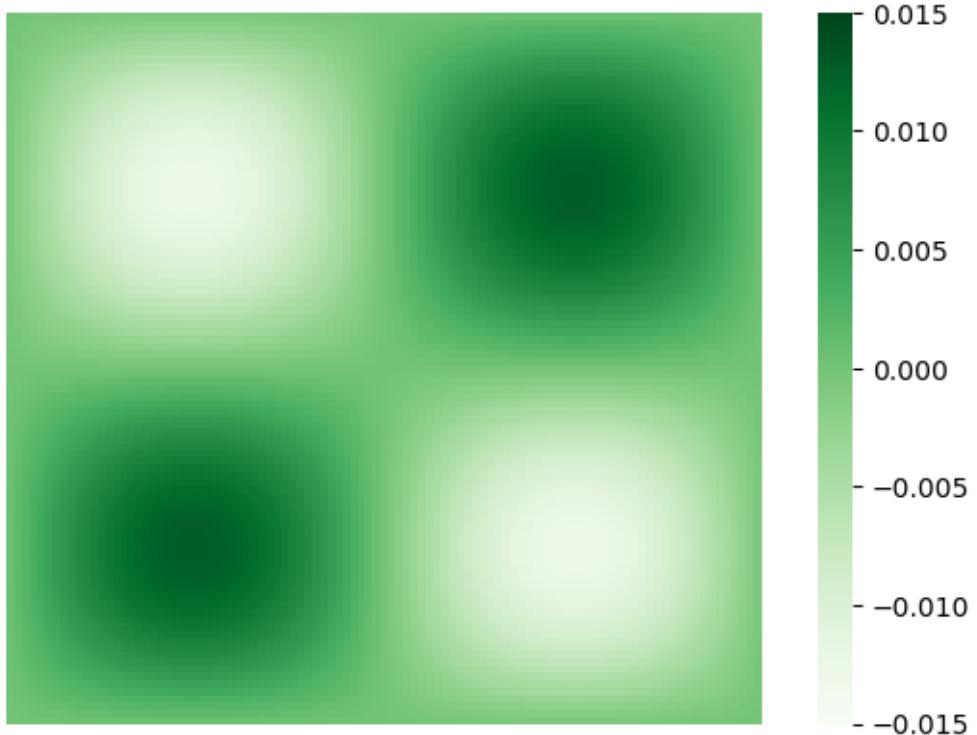
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Numerical Solution: Time = 0.71 s



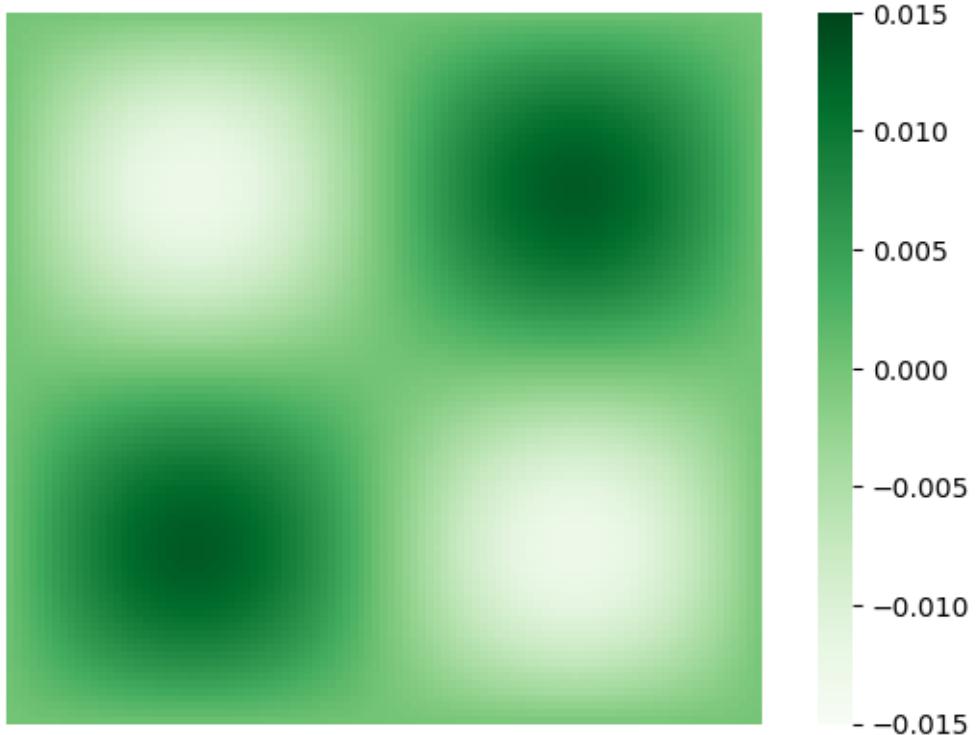
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Numerical Solution: Time = 0.715 s



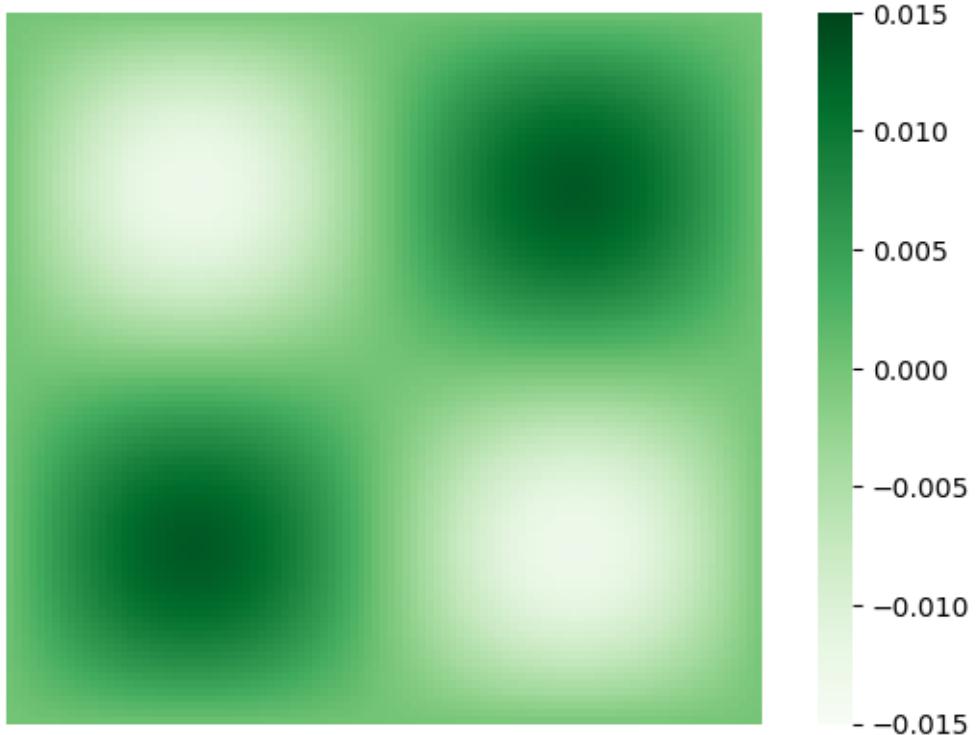
Q_4_Numerical_Solution_at_time_0.720000_.csv

Numerical Solution: Time = 0.72 s



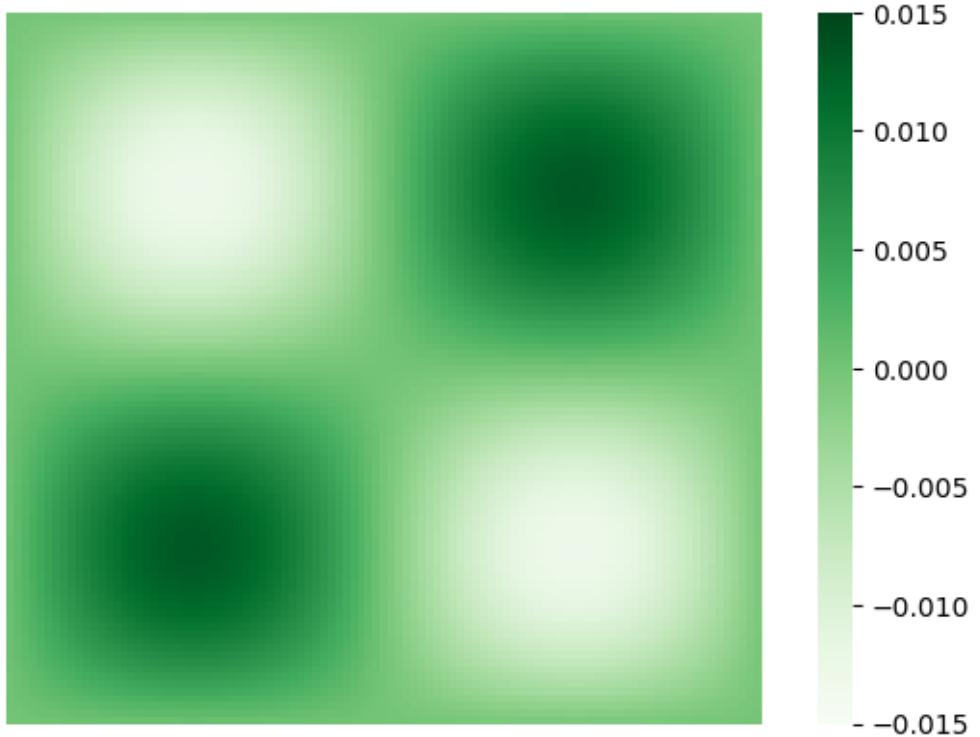
Q_4_Numerical_Solution_at_time_0.725000_.csv

Numerical Solution: Time = 0.725 s



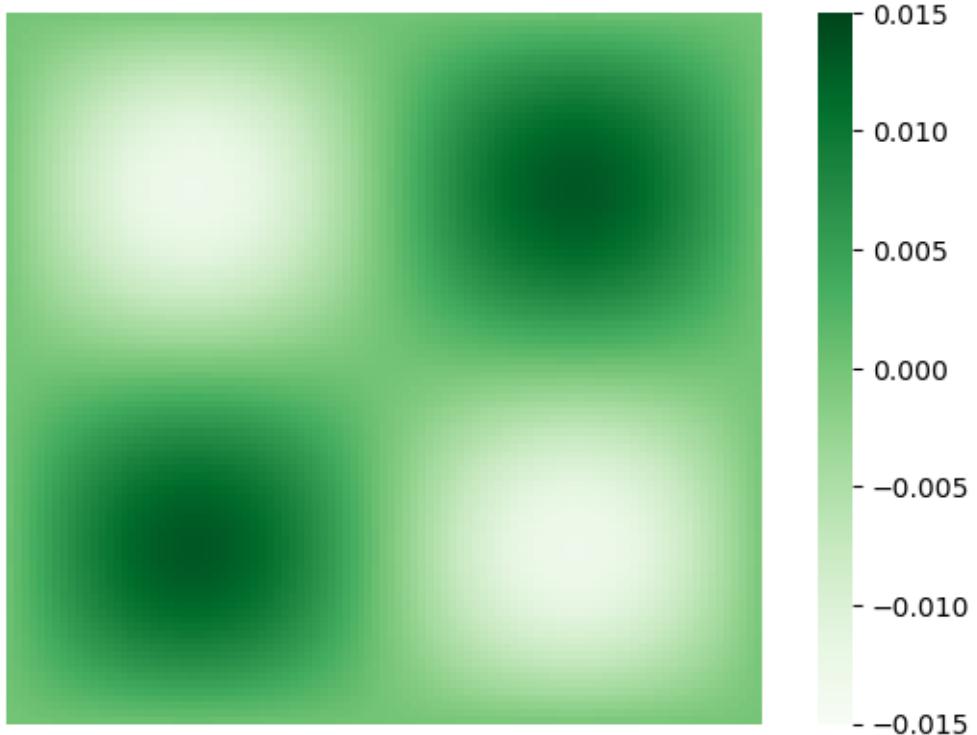
Q_4_Numerical_Solution_at_time_0.730000_.csv

Numerical Solution: Time = 0.73 s



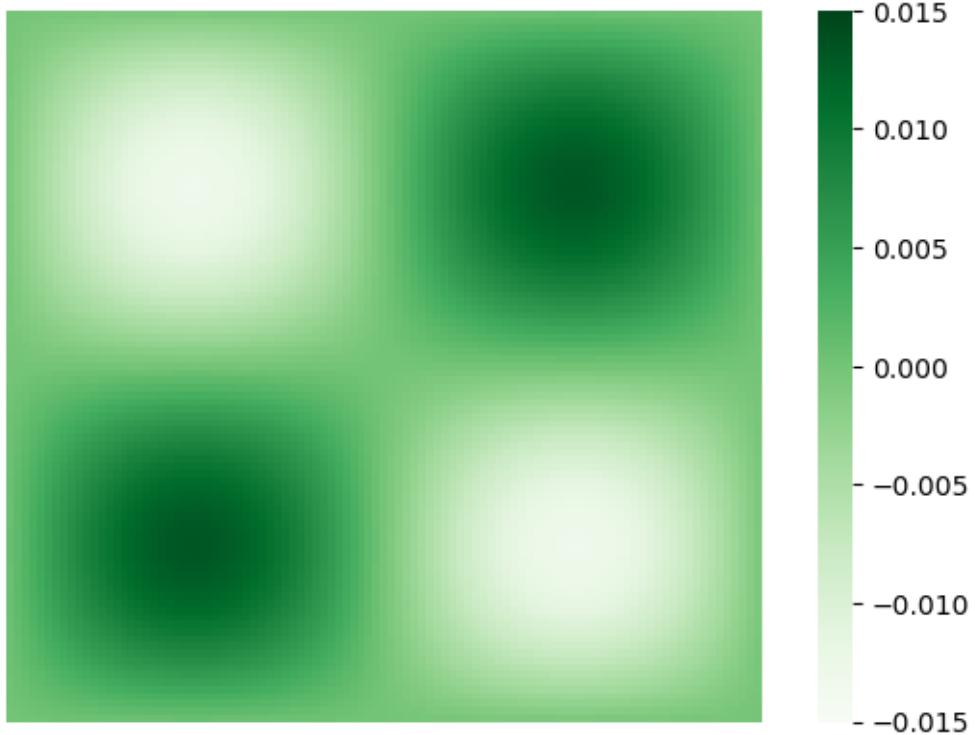
Q_4_Numerical_Solution_at_time_0.735000_.csv

Numerical Solution: Time = 0.735 s



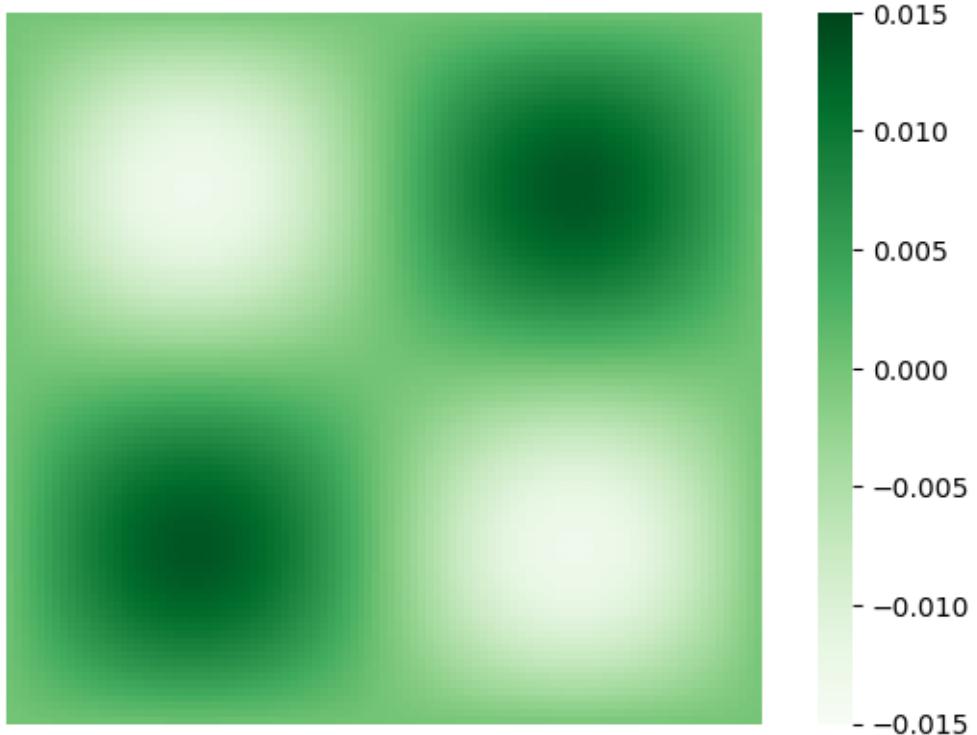
Q_4_Numerical_Solution_at_time_0.740000_.csv

Numerical Solution: Time = 0.74 s



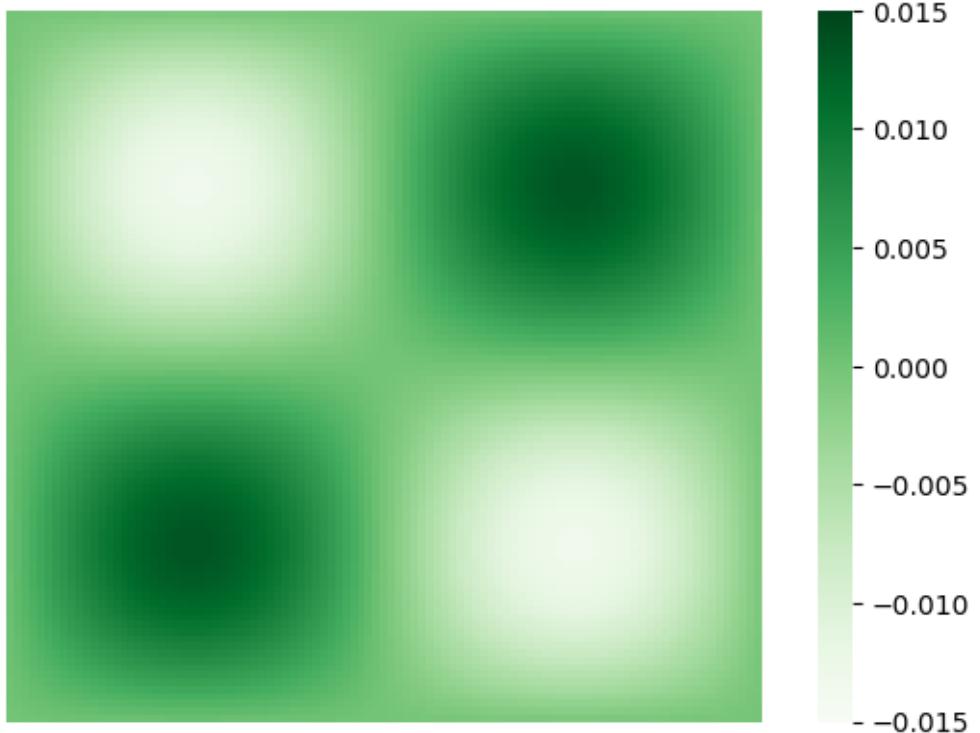
Q_4_Numerical_Solution_at_time_0.745000_.csv

Numerical Solution: Time = 0.745 s



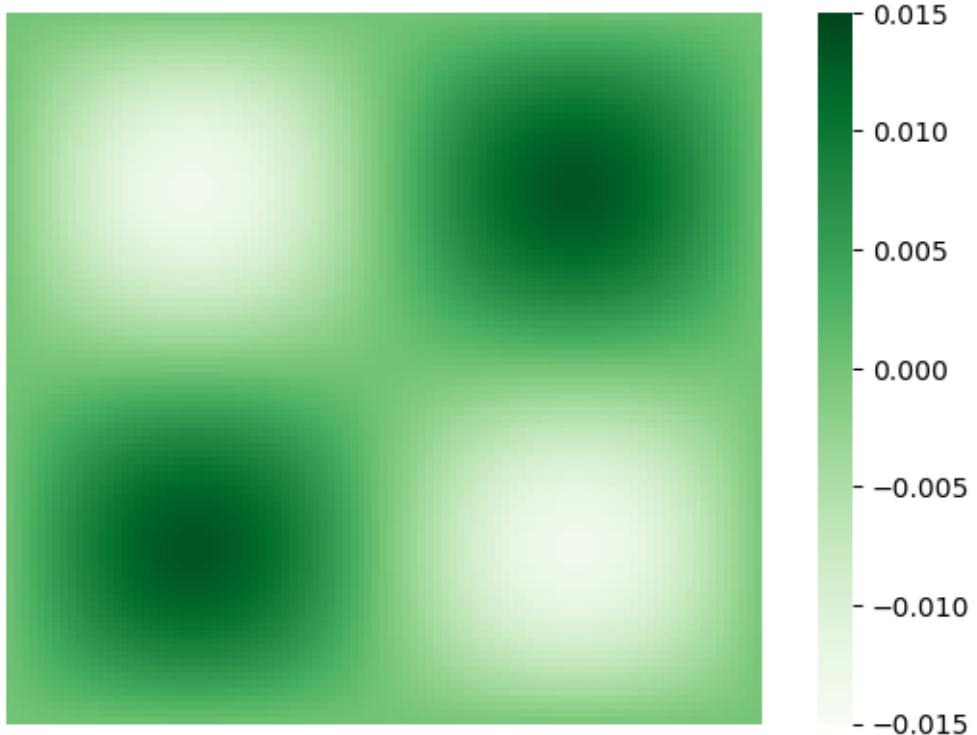
Q_4_Numerical_Solution_at_time_0.750000_.csv

Numerical Solution: Time = 0.75 s



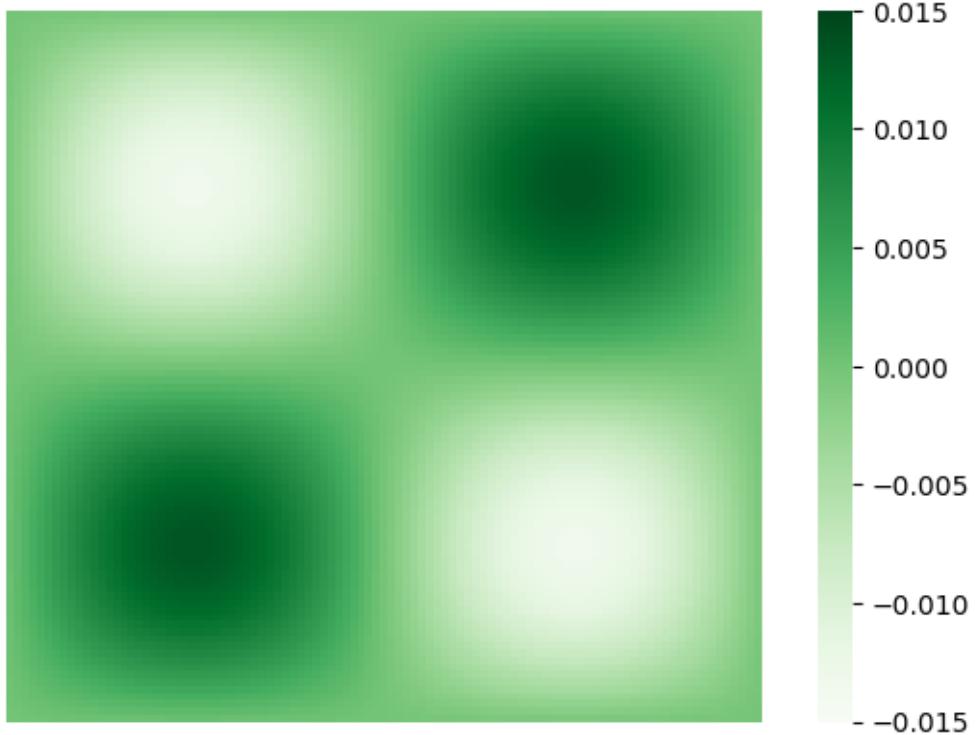
Q_4_Numerical_Solution_at_time_0.755000_.csv

Numerical Solution: Time = 0.755 s



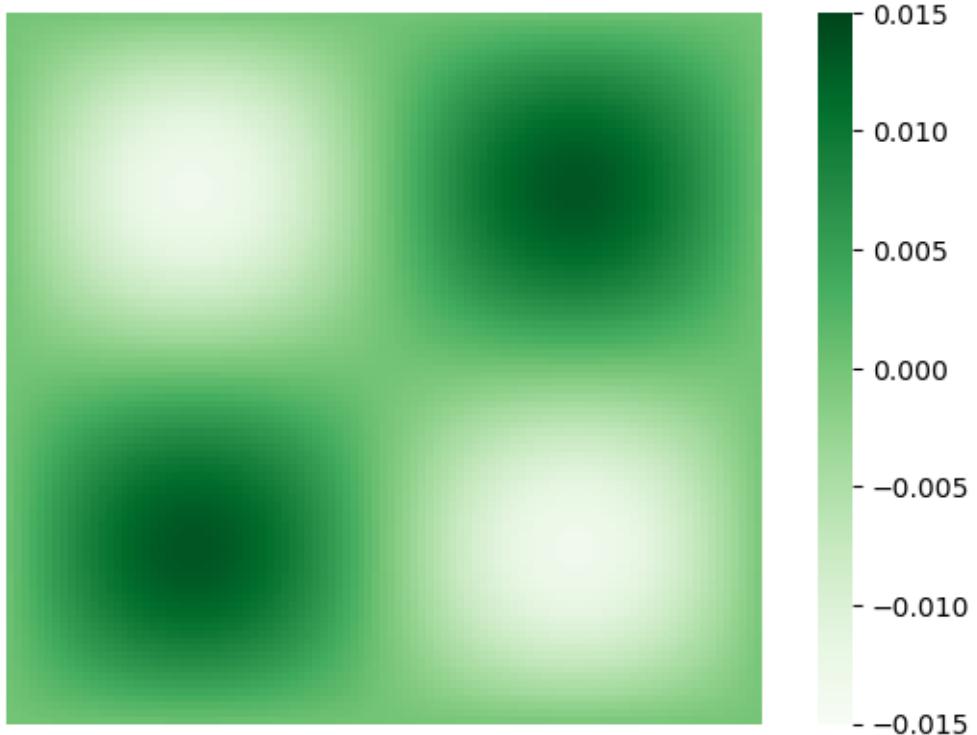
Q_4_Numerical_Solution_at_time_0.760000_.csv

Numerical Solution: Time = 0.76 s



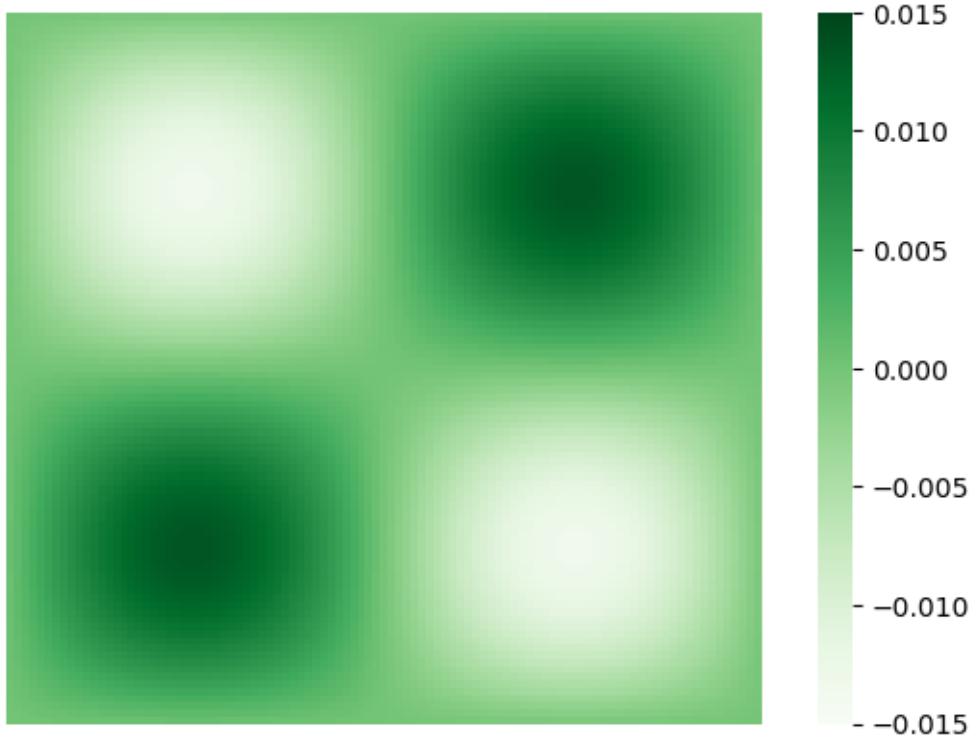
Q_4_Numerical_Solution_at_time_0.765000_.csv

Numerical Solution: Time = 0.765 s



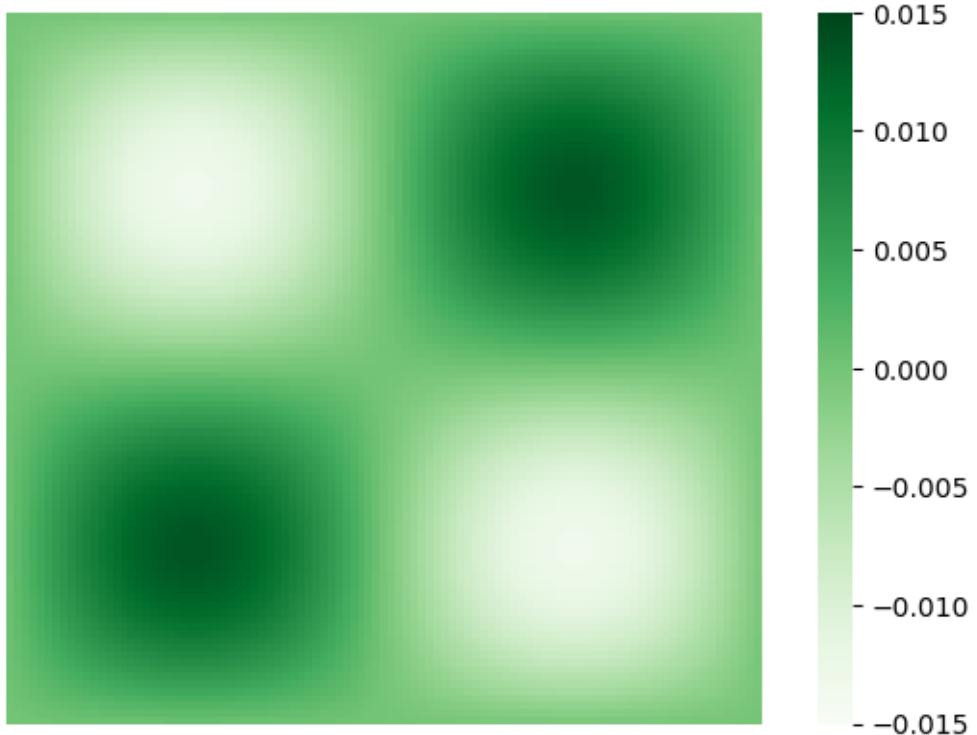
Q_4_Numerical_Solution_at_time_0.770000_.csv

Numerical Solution: Time = 0.77 s



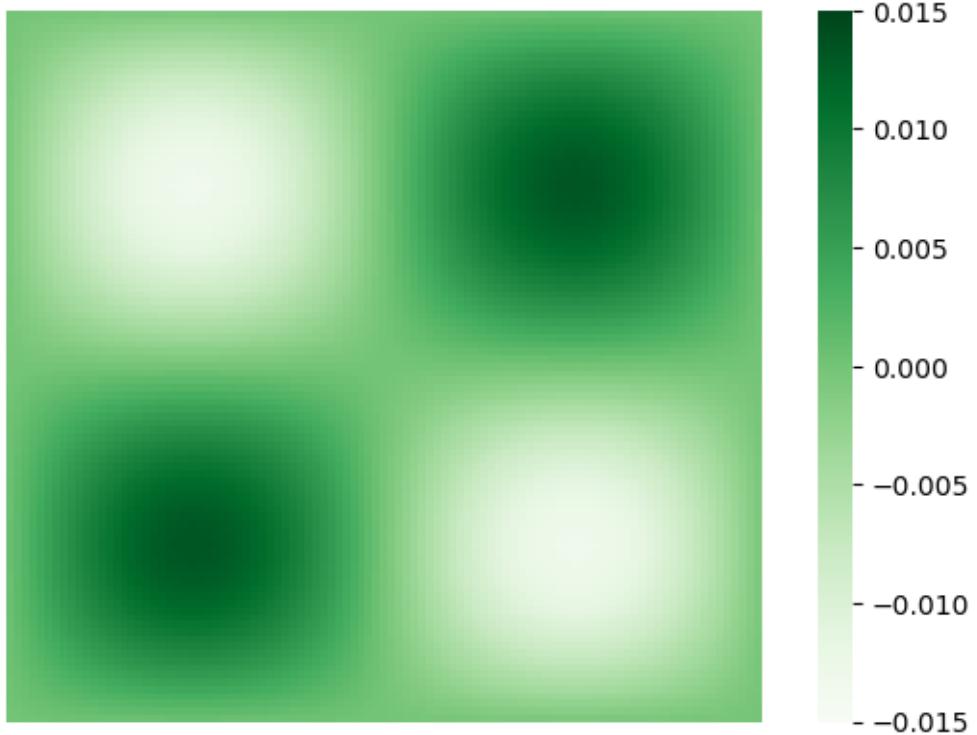
Q_4_Numerical_Solution_at_time_0.775000_.csv

Numerical Solution: Time = 0.775 s



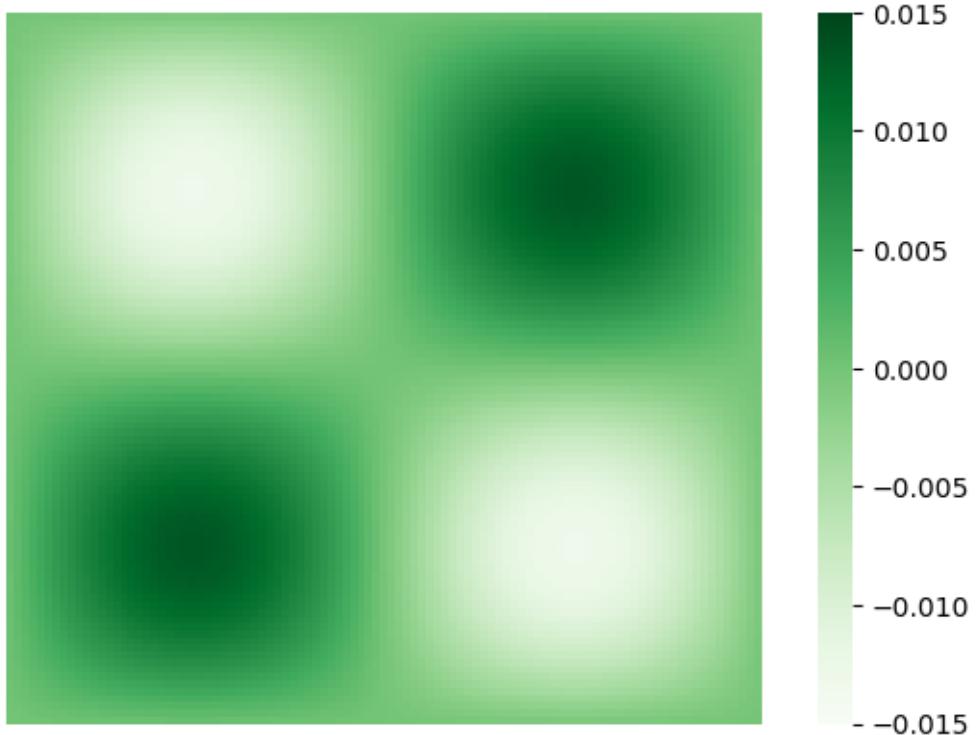
Q_4_Numerical_Solution_at_time_0.780000_.csv

Numerical Solution: Time = 0.78 s



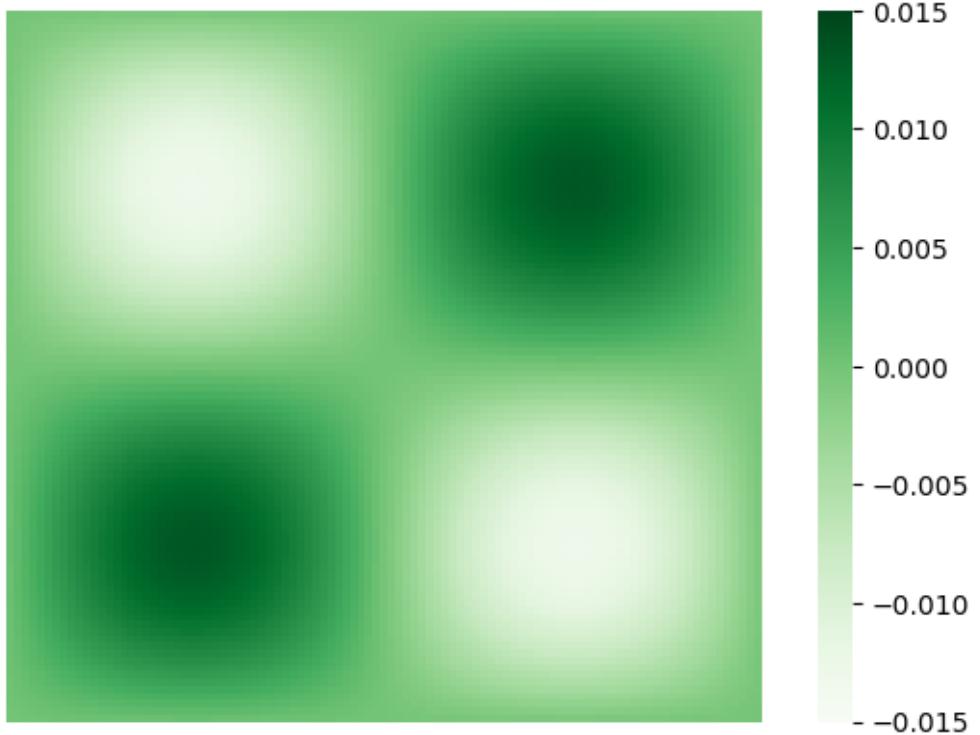
Q_4_Numerical_Solution_at_time_0.785000_.csv

Numerical Solution: Time = 0.785 s



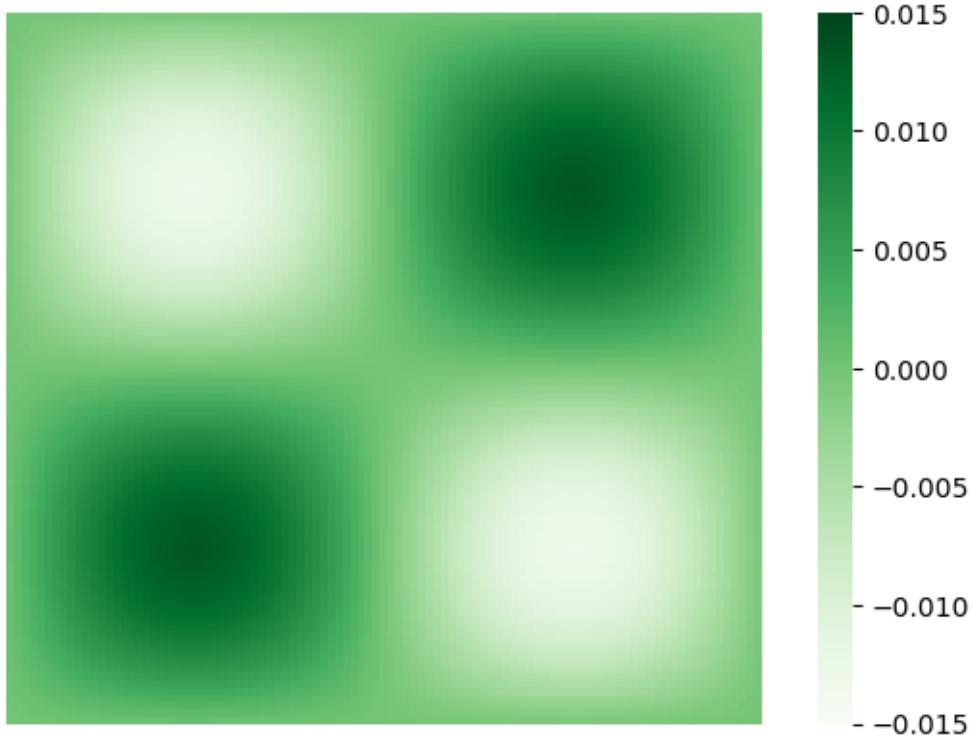
Q_4_Numerical_Solution_at_time_0.790000_.csv

Numerical Solution: Time = 0.79 s



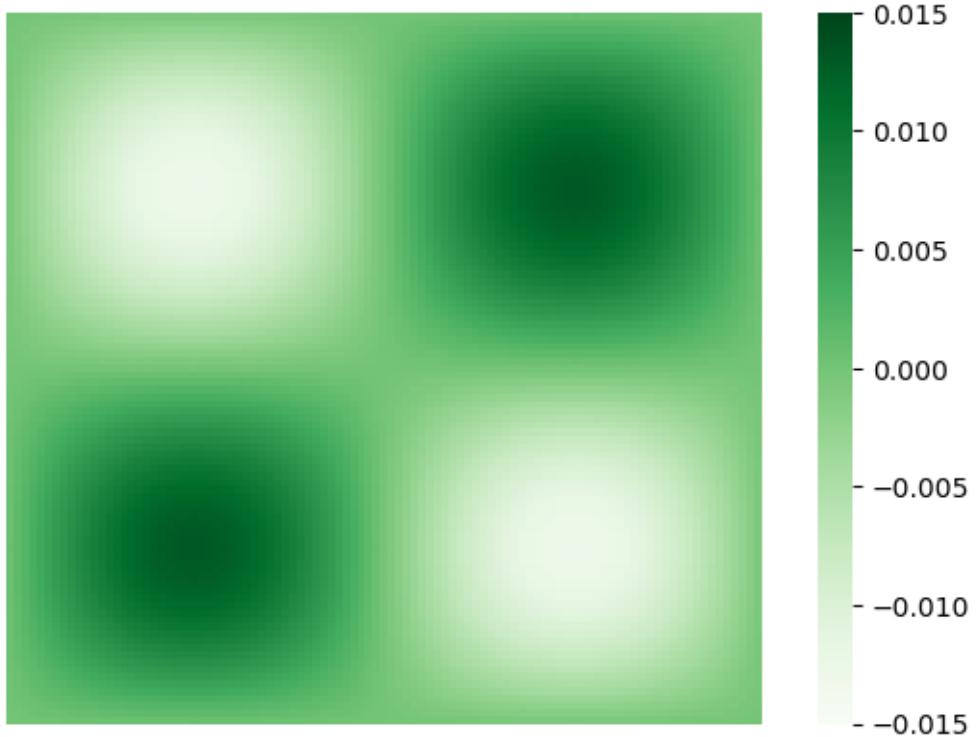
Q_4_Numerical_Solution_at_time_0.795000_.csv

Numerical Solution: Time = 0.795 s



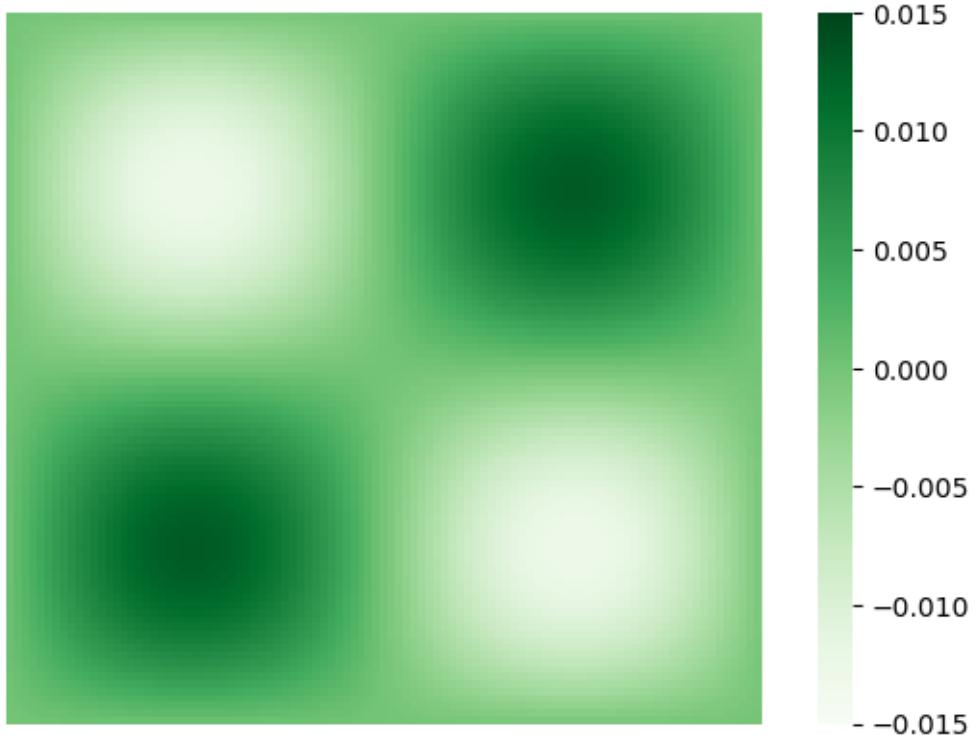
Q_4_Numerical_Solution_at_time_0.800000_.csv

Numerical Solution: Time = 0.8 s



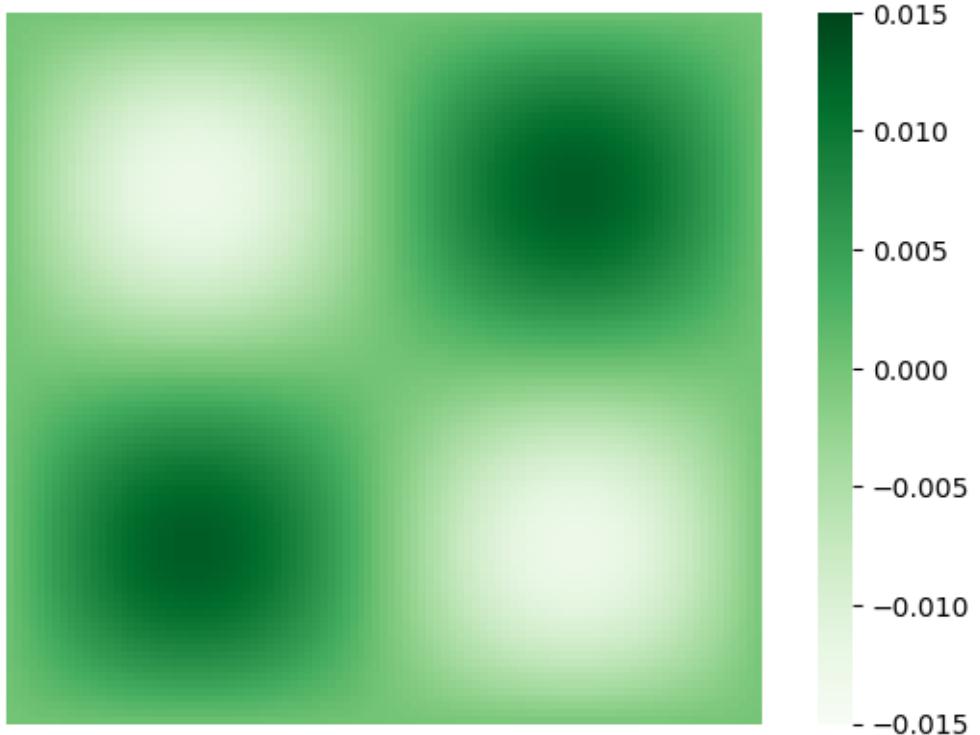
Q_4_Numerical_Solution_at_time_0.805000_.csv

Numerical Solution: Time = 0.805 s



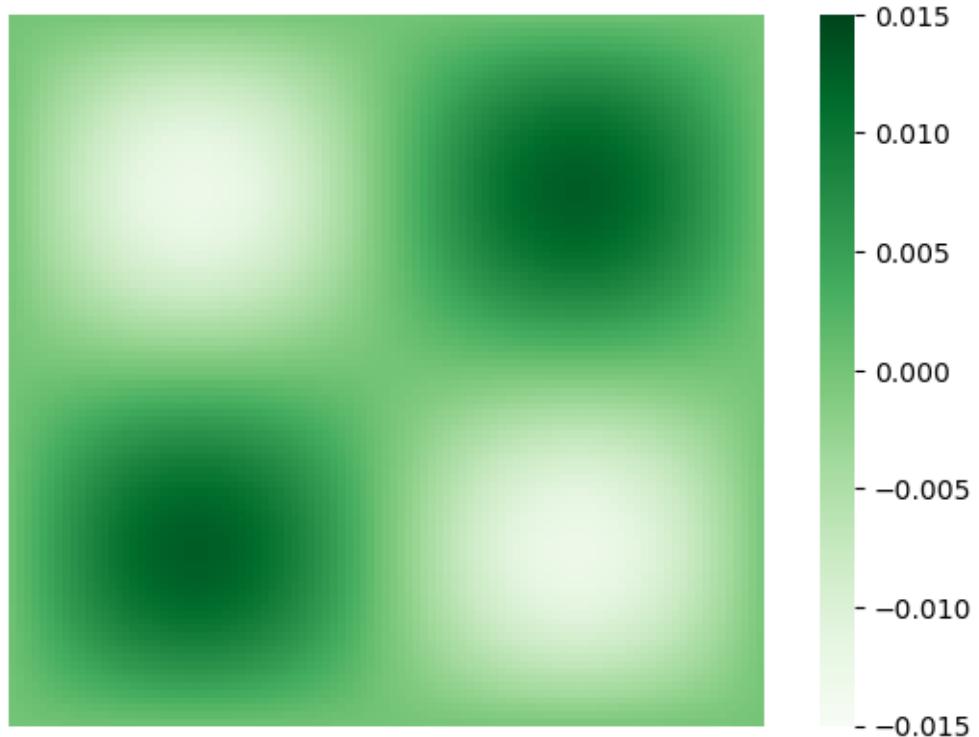
Q_4_Numerical_Solution_at_time_0.810000_.csv

Numerical Solution: Time = 0.81 s



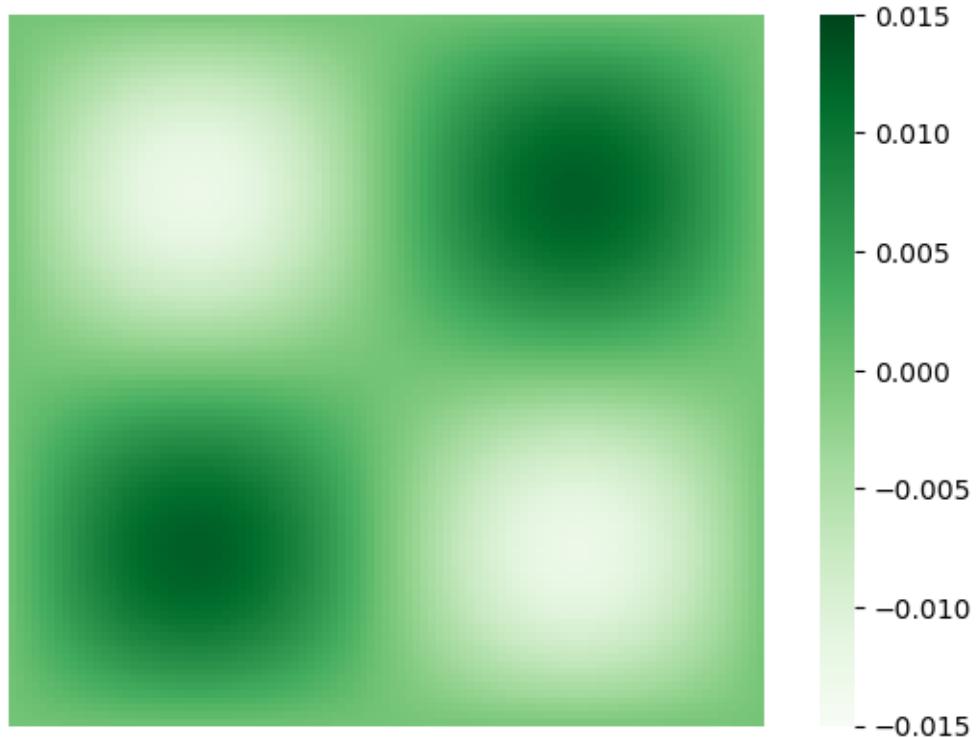
Q_4_Numerical_Solution_at_time_0.815000_.csv

Numerical Solution: Time = 0.8150000000000001 s



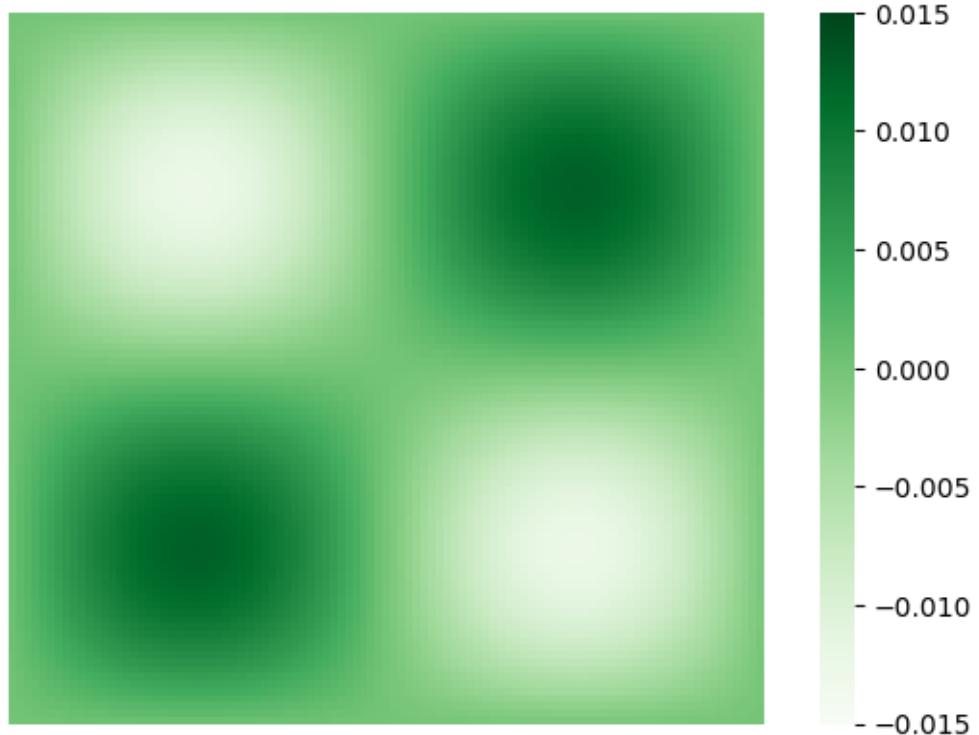
Q_4_Numerical_Solution_at_time_0.820000_.csv

Numerical Solution: Time = 0.8200000000000001 s



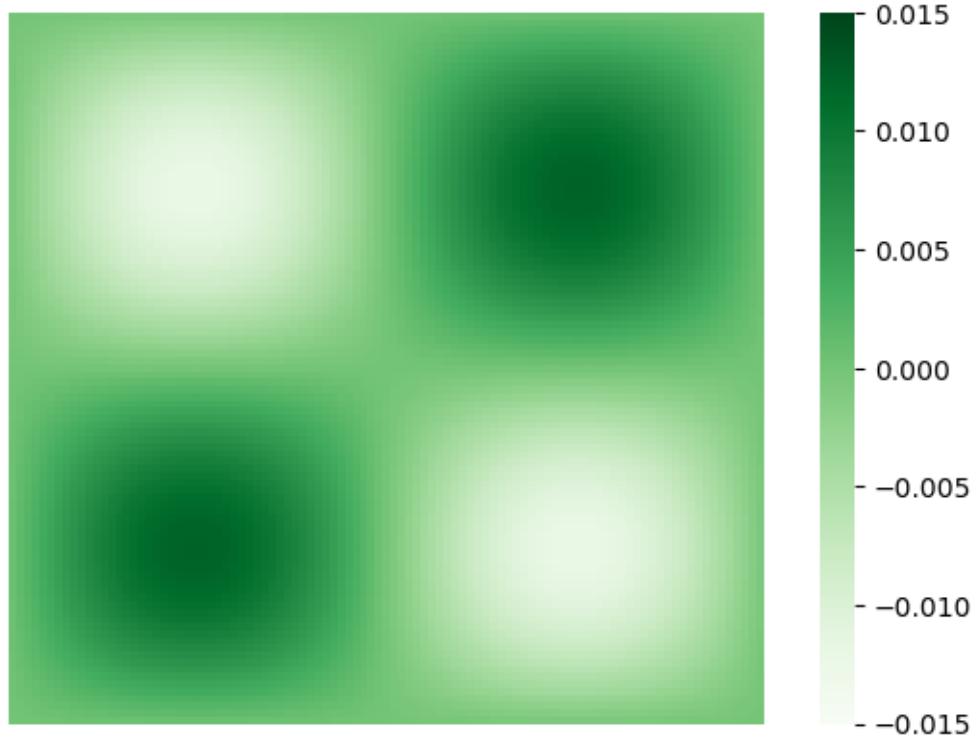
Q_4_Numerical_Solution_at_time_0.825000_.csv

Numerical Solution: Time = 0.8250000000000001 s



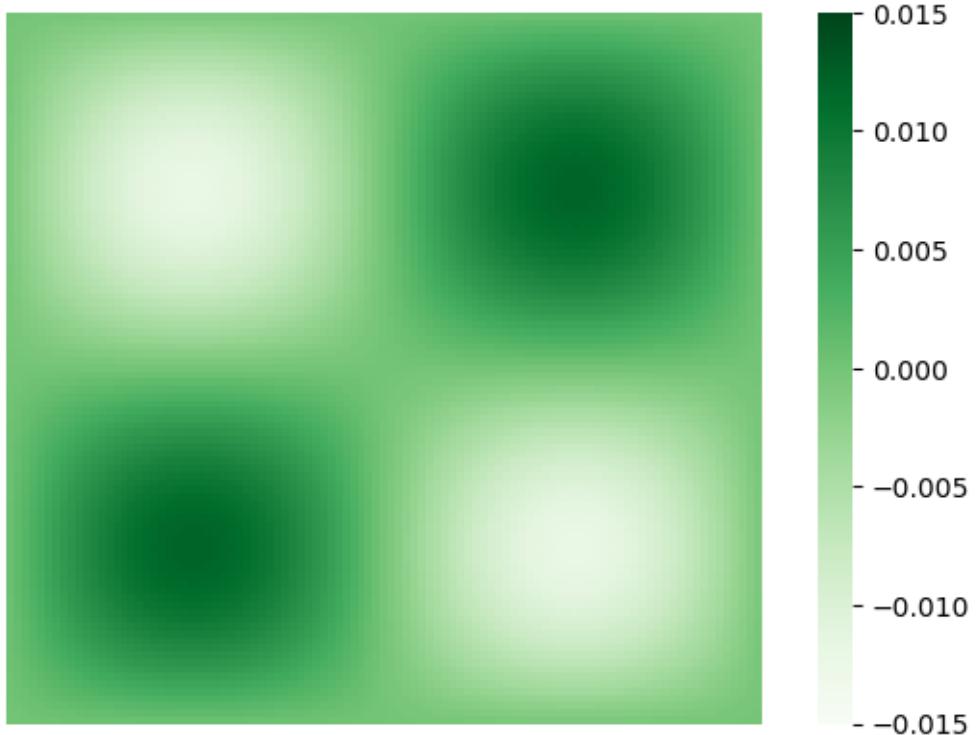
Q_4_Numerical_Solution_at_time_0.830000_.csv

Numerical Solution: Time = 0.8300000000000001 s



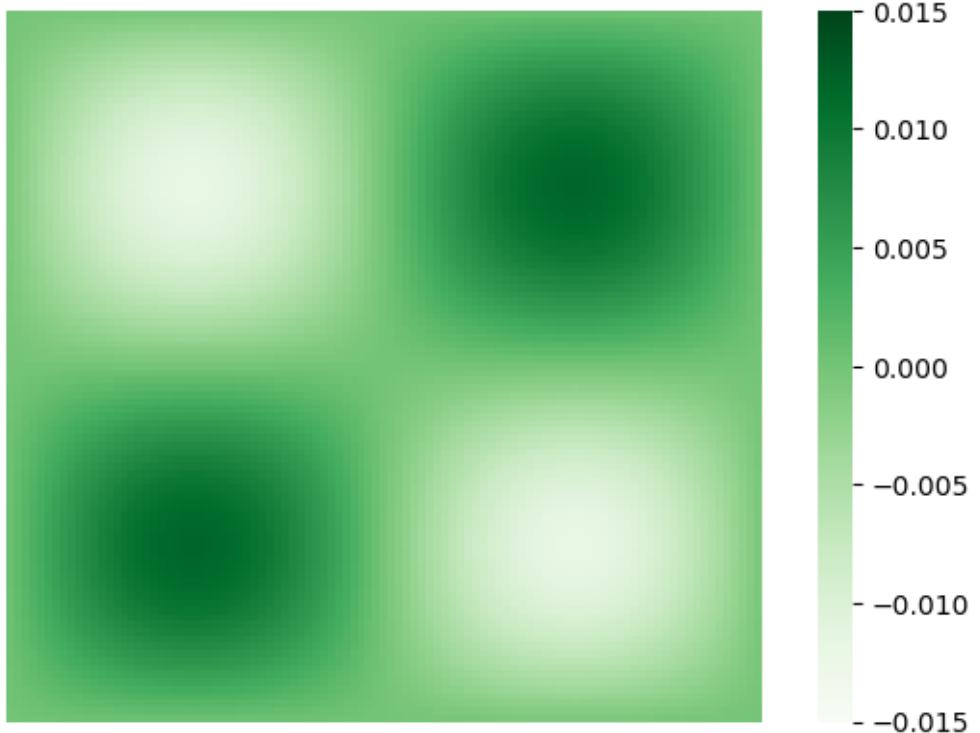
Q_4_Numerical_Solution_at_time_0.835000_.csv

Numerical Solution: Time = 0.835 s



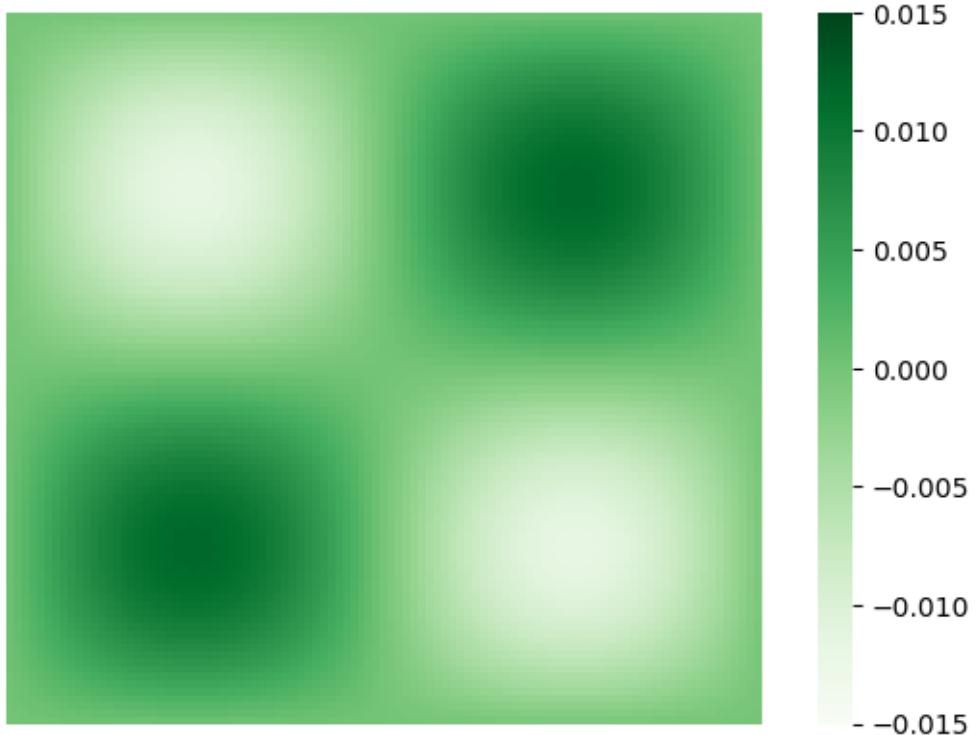
Q_4_Numerical_Solution_at_time_0.840000_.csv

Numerical Solution: Time = 0.84 s



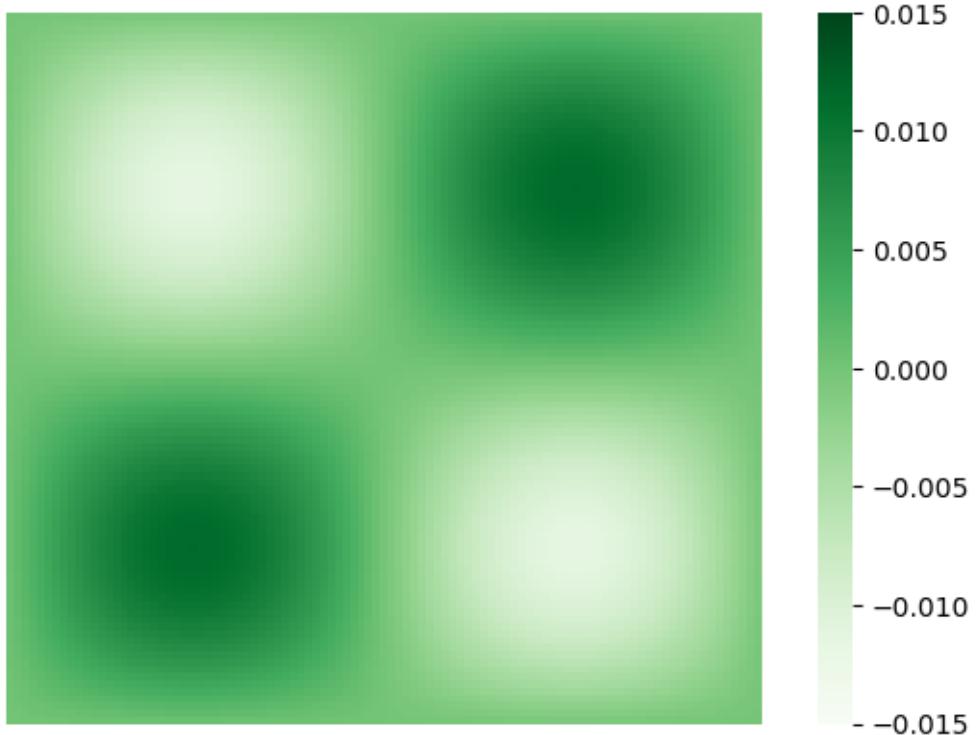
Q_4_Numerical_Solution_at_time_0.845000_.csv

Numerical Solution: Time = 0.845 s



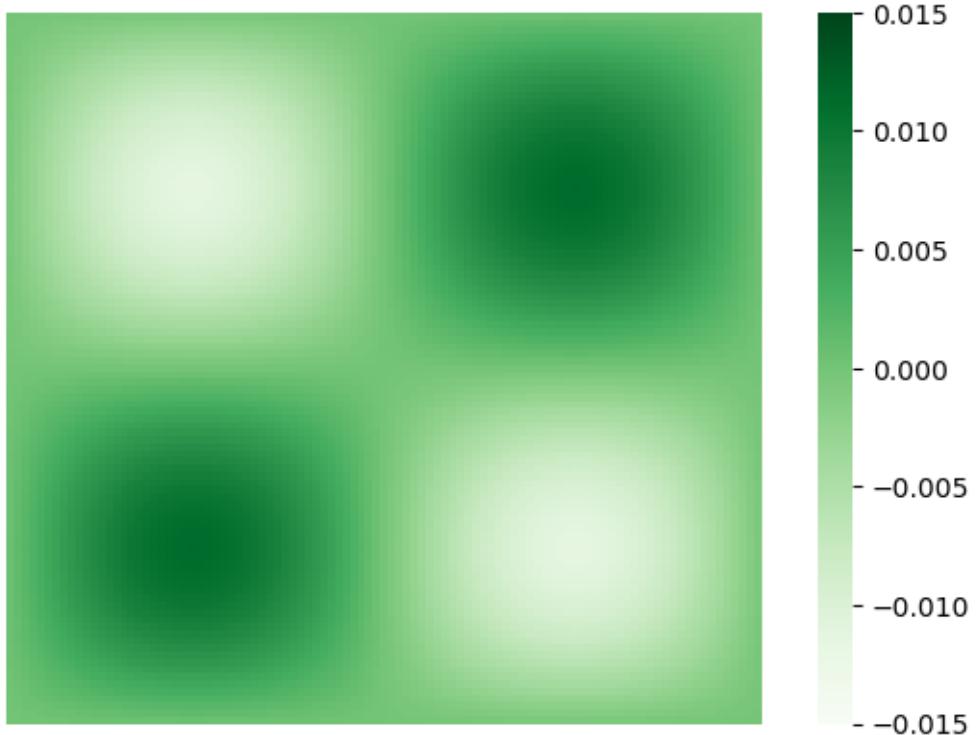
Q_4_Numerical_Solution_at_time_0.850000_.csv

Numerical Solution: Time = 0.85 s



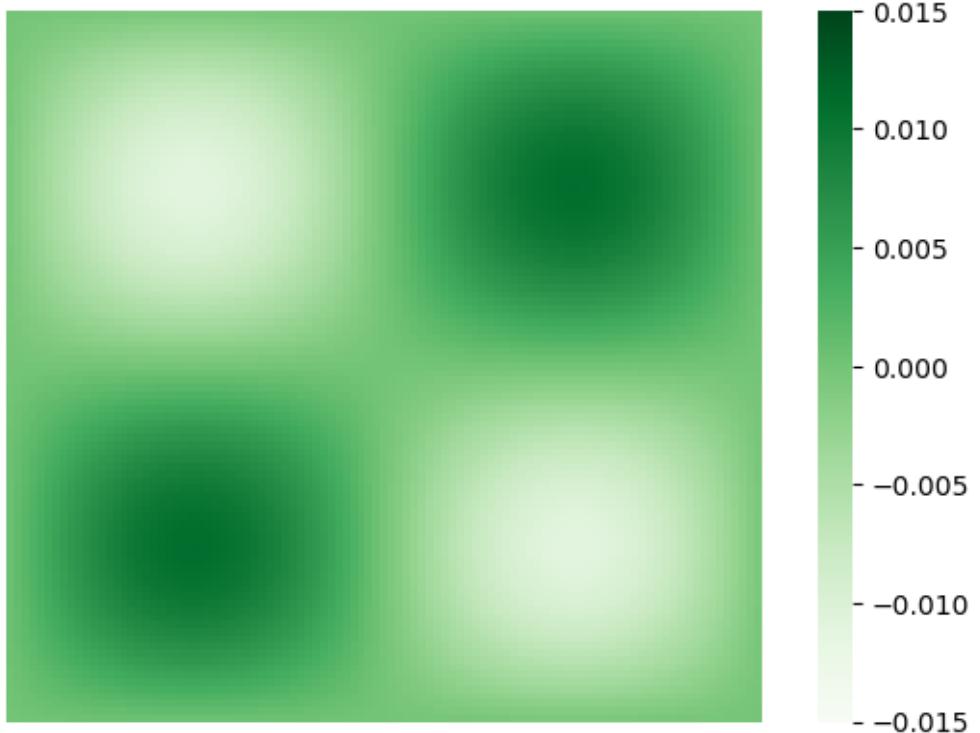
Q_4_Numerical_Solution_at_time_0.855000_.csv

Numerical Solution: Time = 0.855 s



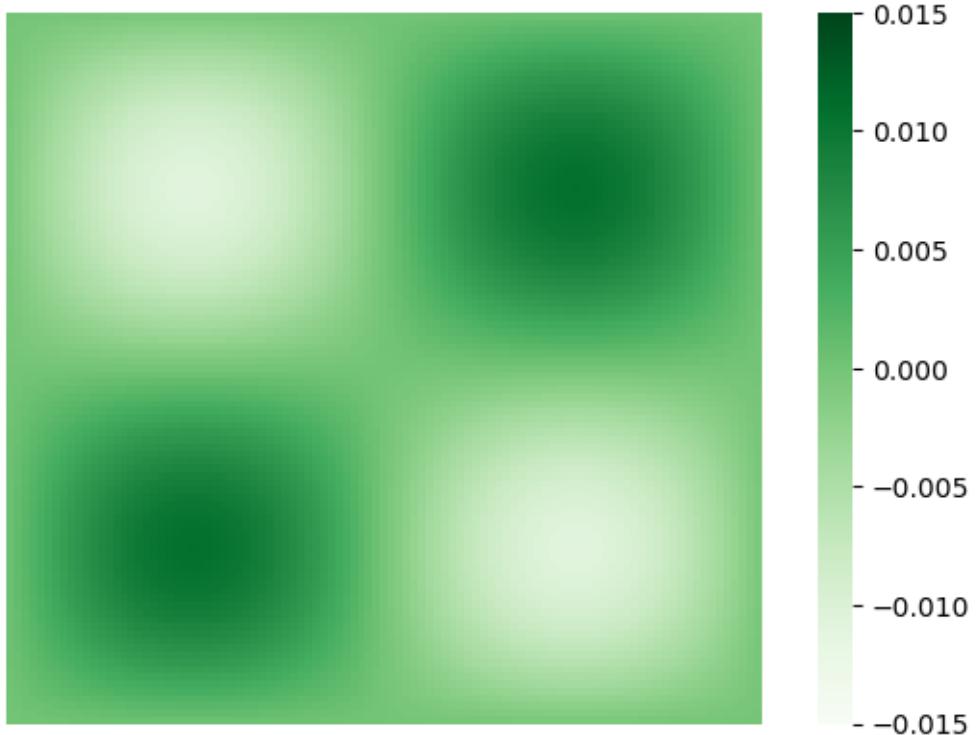
Q_4_Numerical_Solution_at_time_0.860000_.csv

Numerical Solution: Time = 0.86 s



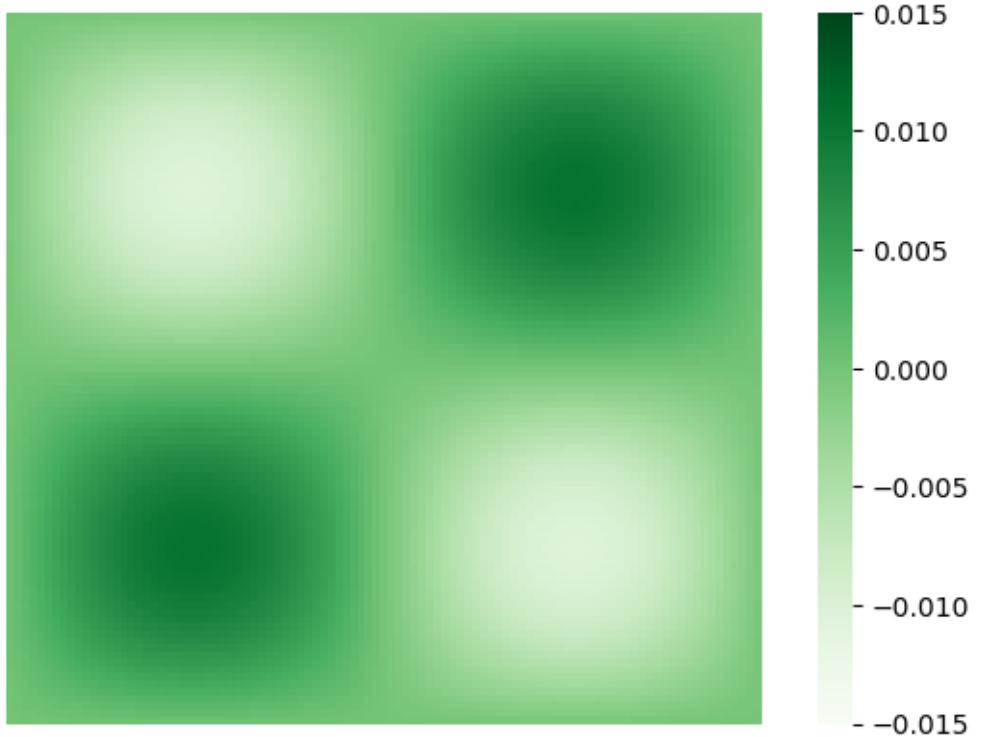
Q_4_Numerical_Solution_at_time_0.865000_.csv

Numerical Solution: Time = 0.865 s



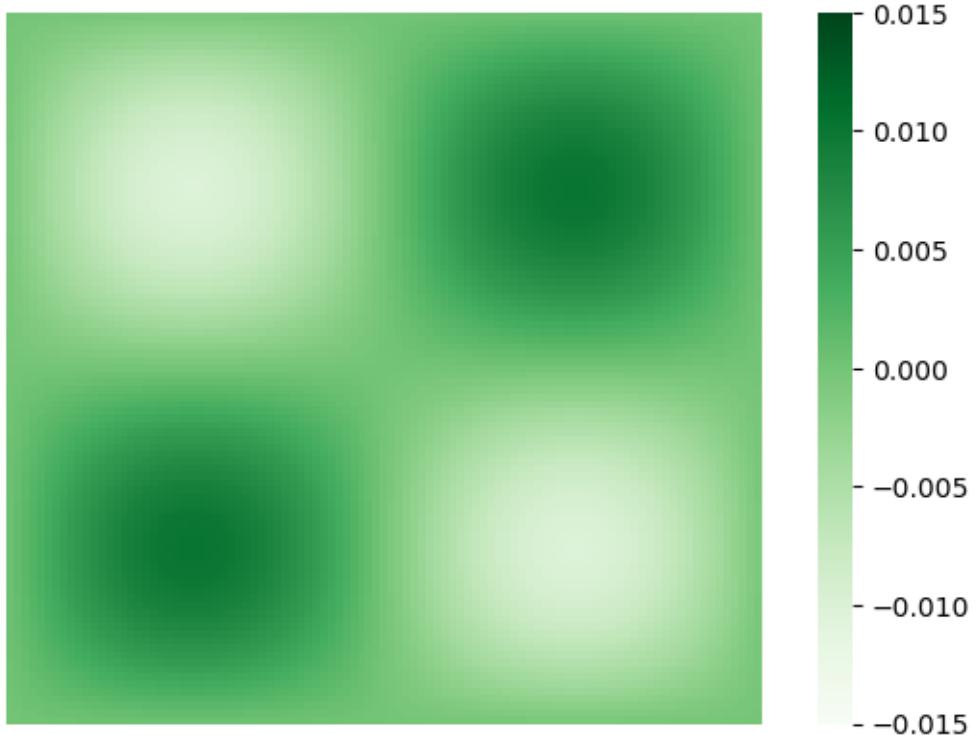
Q_4_Numerical_Solution_at_time_0.870000_.csv

Numerical Solution: Time = 0.87 s



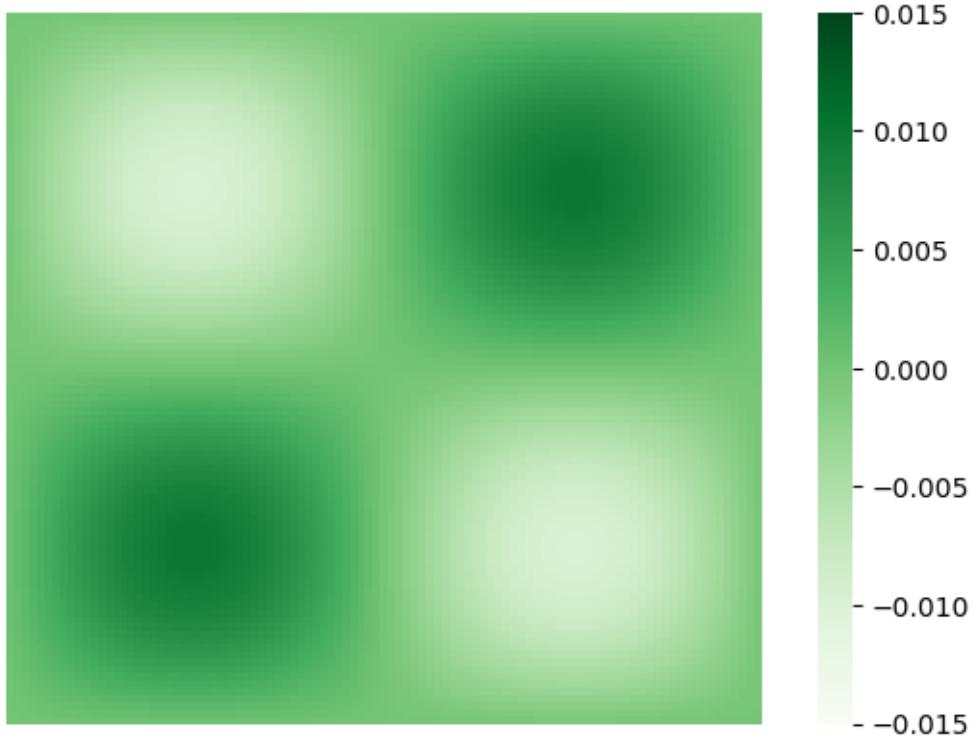
Q_4_Numerical_Solution_at_time_0.875000_.csv

Numerical Solution: Time = 0.875 s



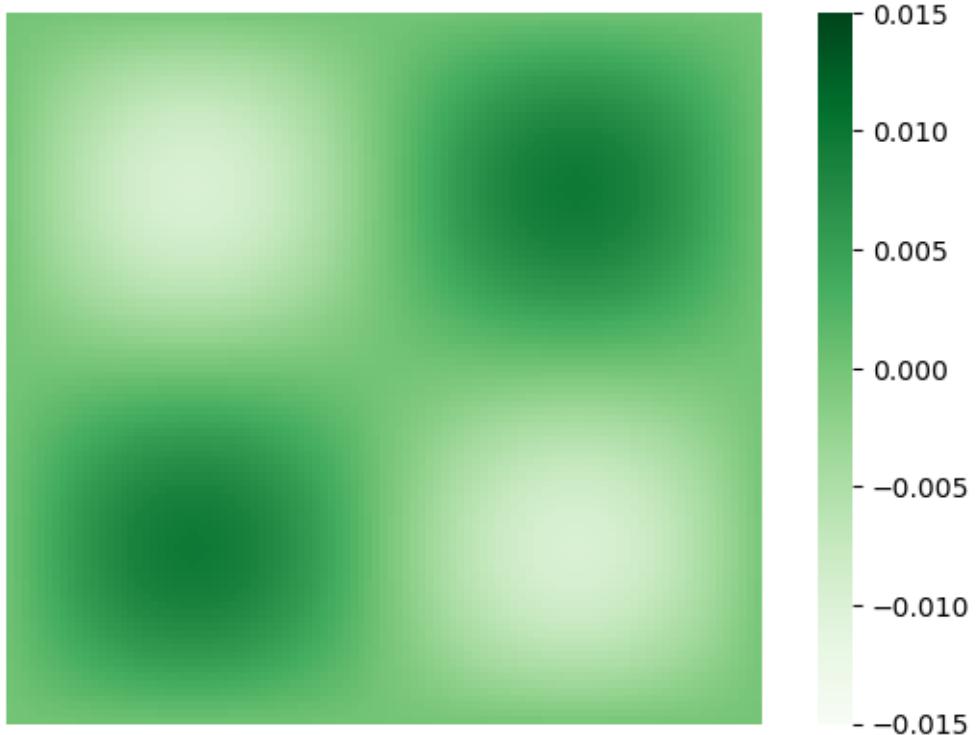
Q_4_Numerical_Solution_at_time_0.880000_.csv

Numerical Solution: Time = 0.88 s



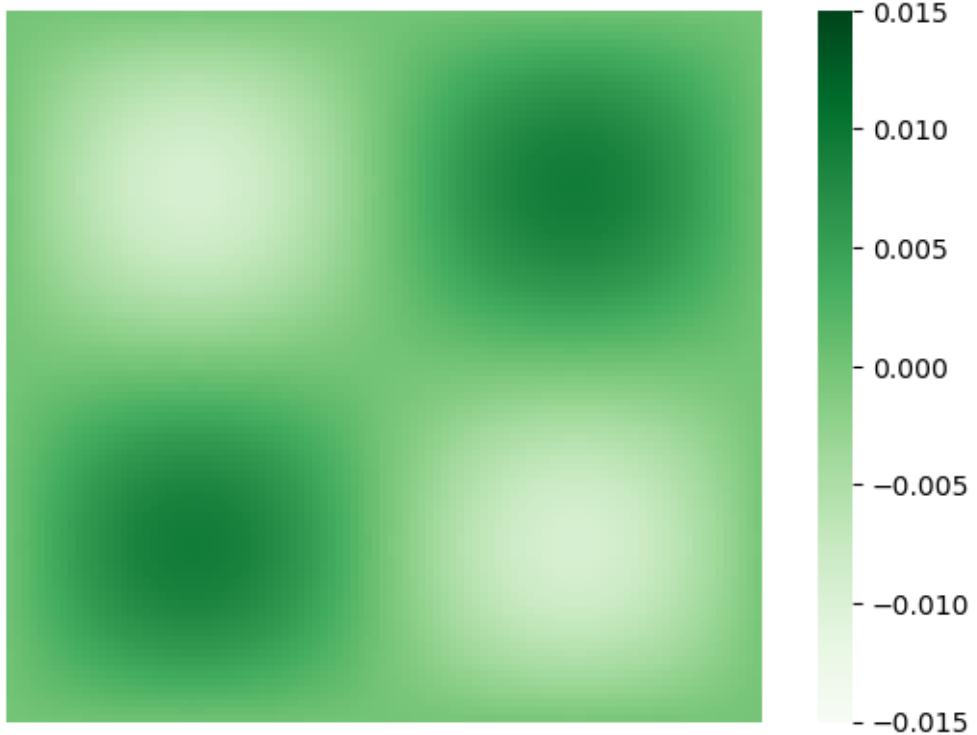
Q_4_Numerical_Solution_at_time_0.885000_.csv

Numerical Solution: Time = 0.885 s



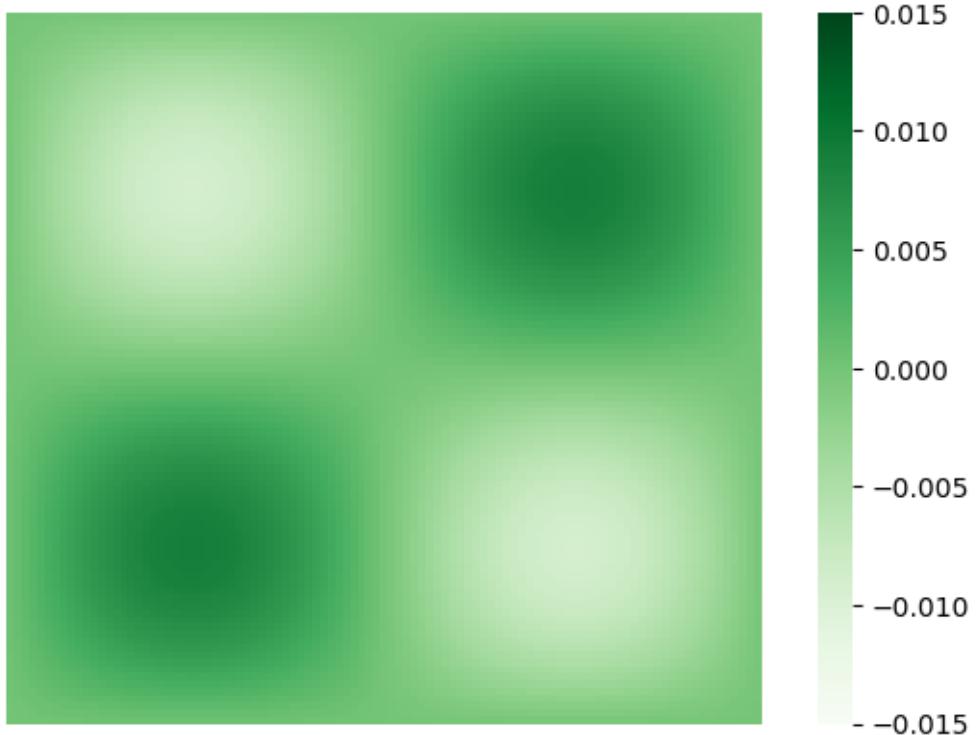
Q_4_Numerical_Solution_at_time_0.890000_.csv

Numerical Solution: Time = 0.89 s



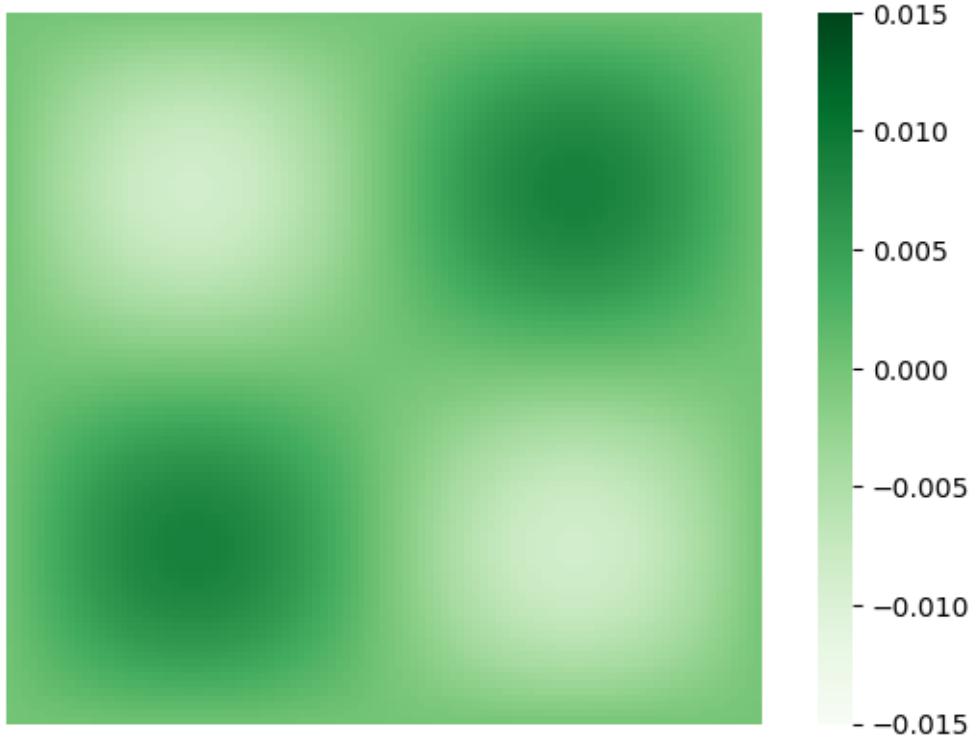
Q_4_Numerical_Solution_at_time_0.895000_.csv

Numerical Solution: Time = 0.895 s



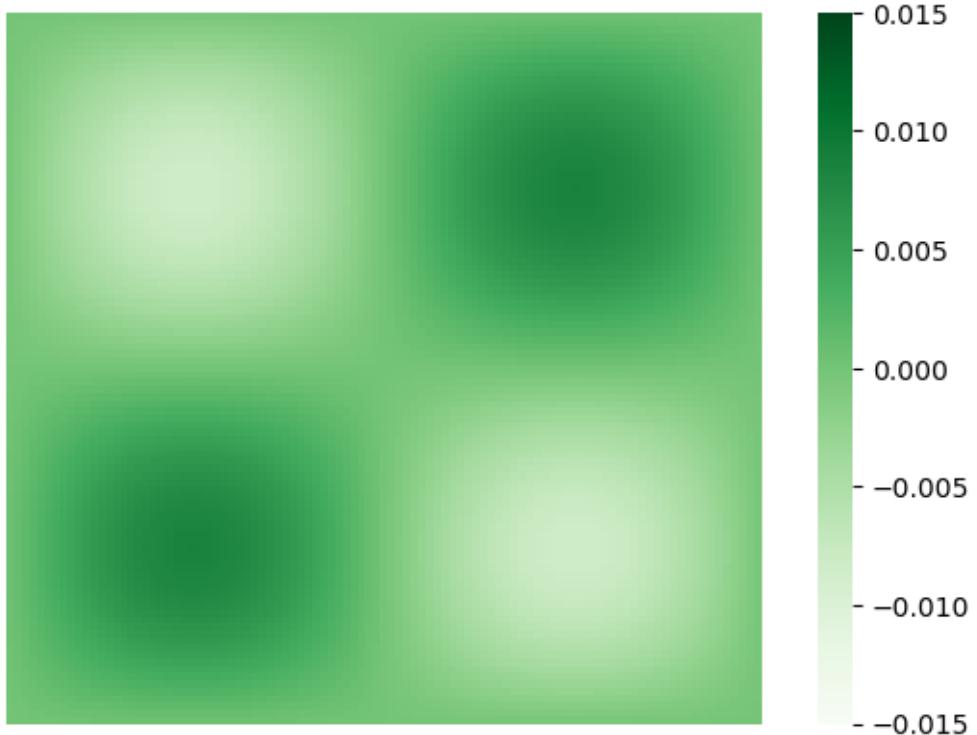
Q_4_Numerical_Solution_at_time_0.900000_.csv

Numerical Solution: Time = 0.9 s



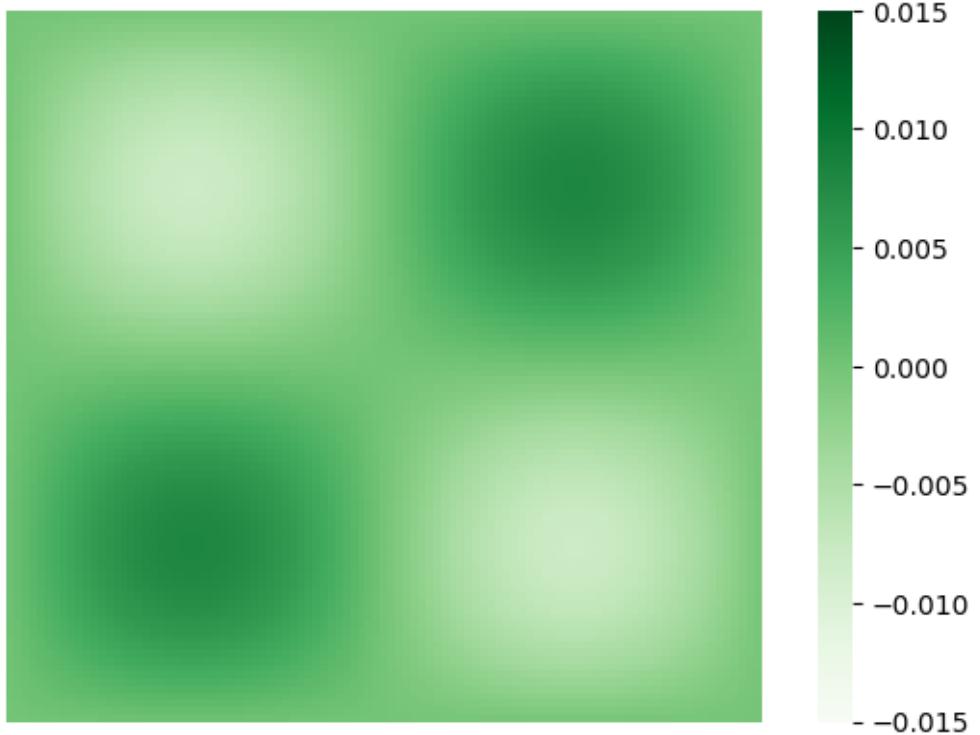
Q_4_Numerical_Solution_at_time_0.905000_.csv

Numerical Solution: Time = 0.905 s



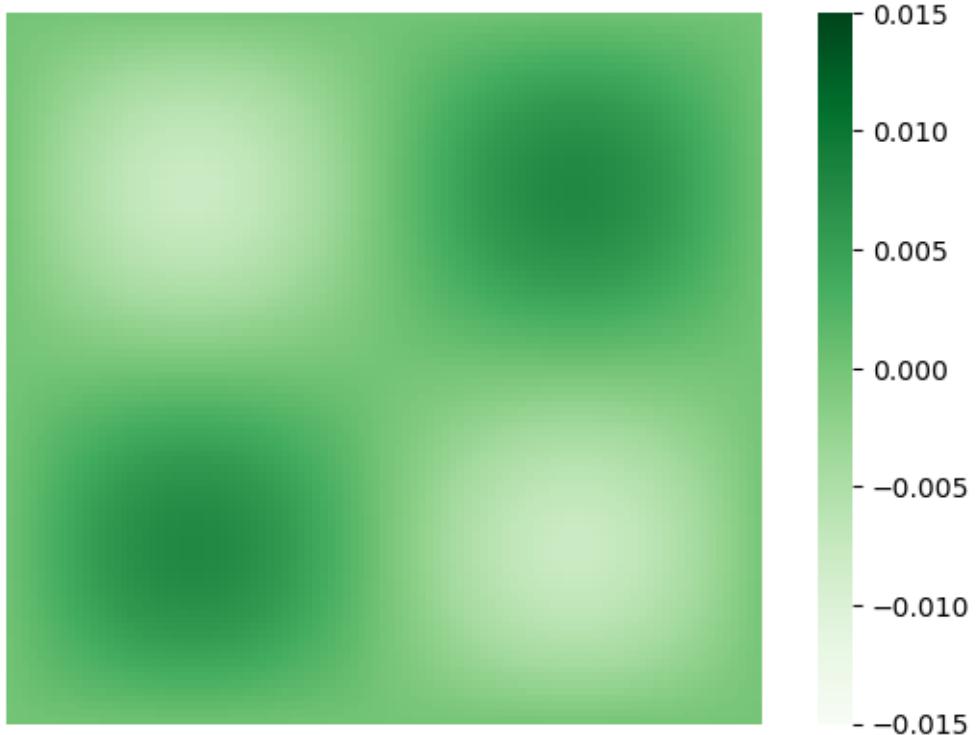
Q_4_Numerical_Solution_at_time_0.910000_.csv

Numerical Solution: Time = 0.91 s



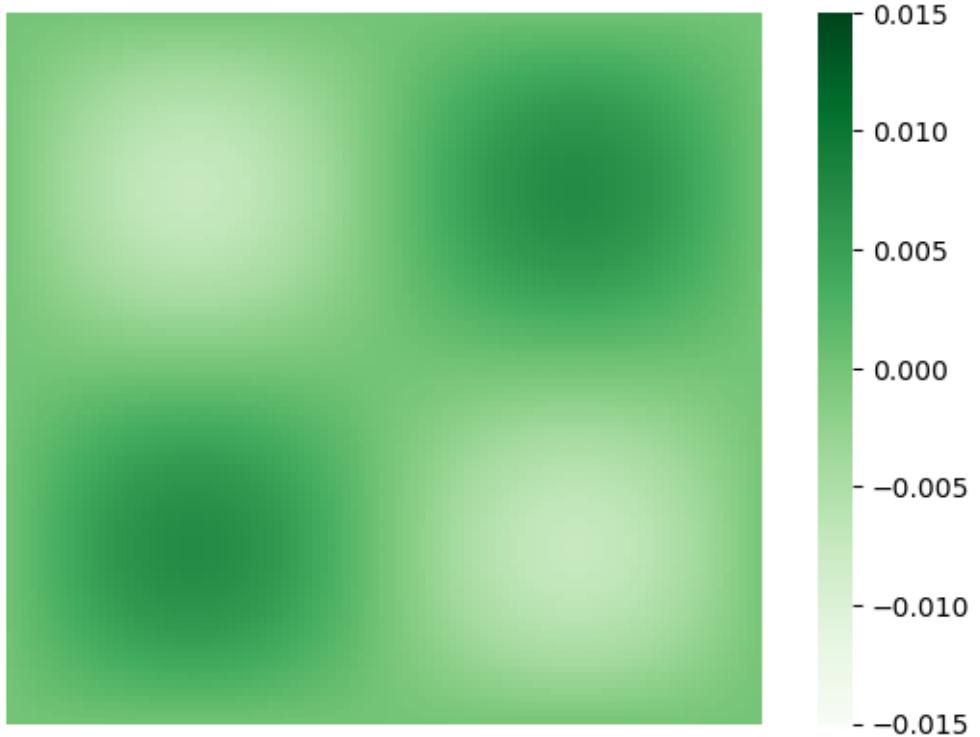
Q_4_Numerical_Solution_at_time_0.915000_.csv

Numerical Solution: Time = 0.915 s



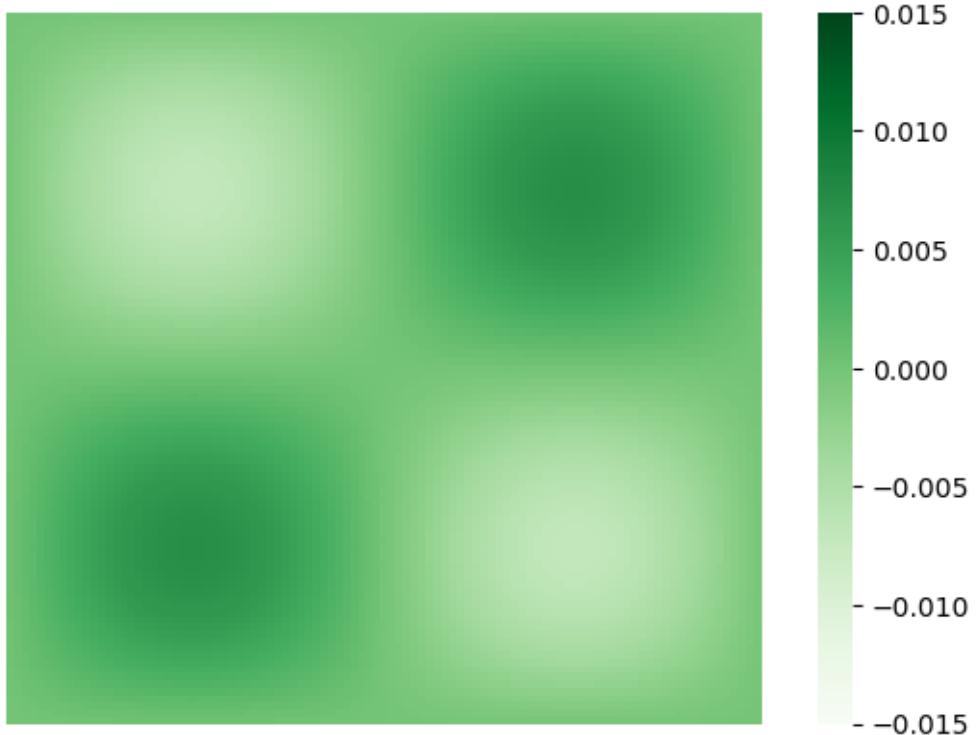
Q_4_Numerical_Solution_at_time_0.920000_.csv

Numerical Solution: Time = 0.92 s



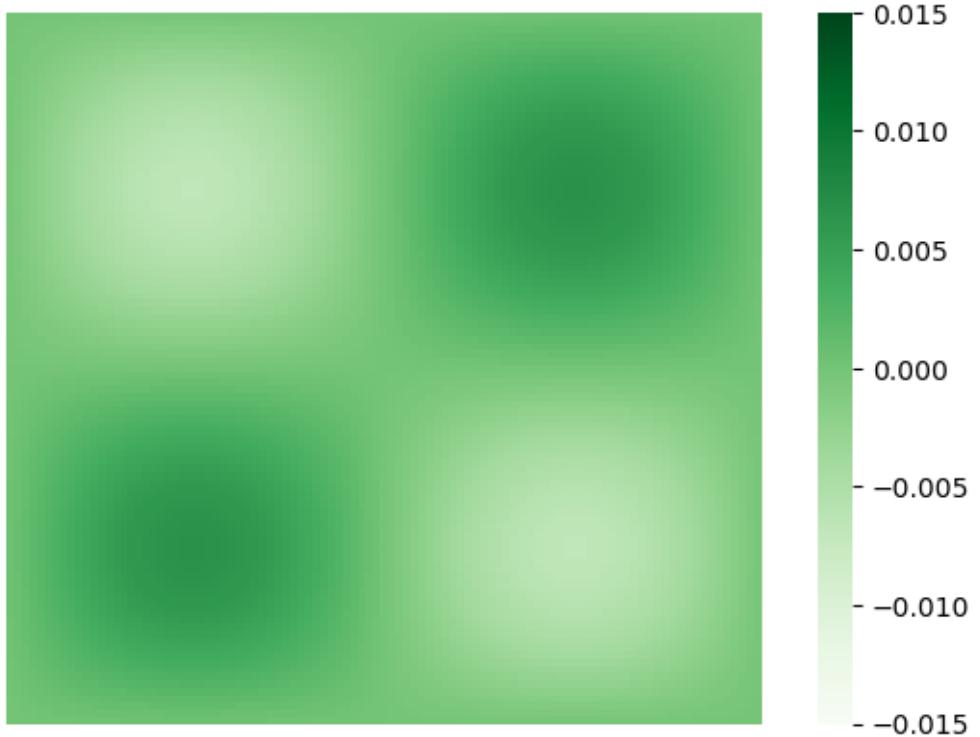
Q_4_Numerical_Solution_at_time_0.925000_.csv

Numerical Solution: Time = 0.925 s



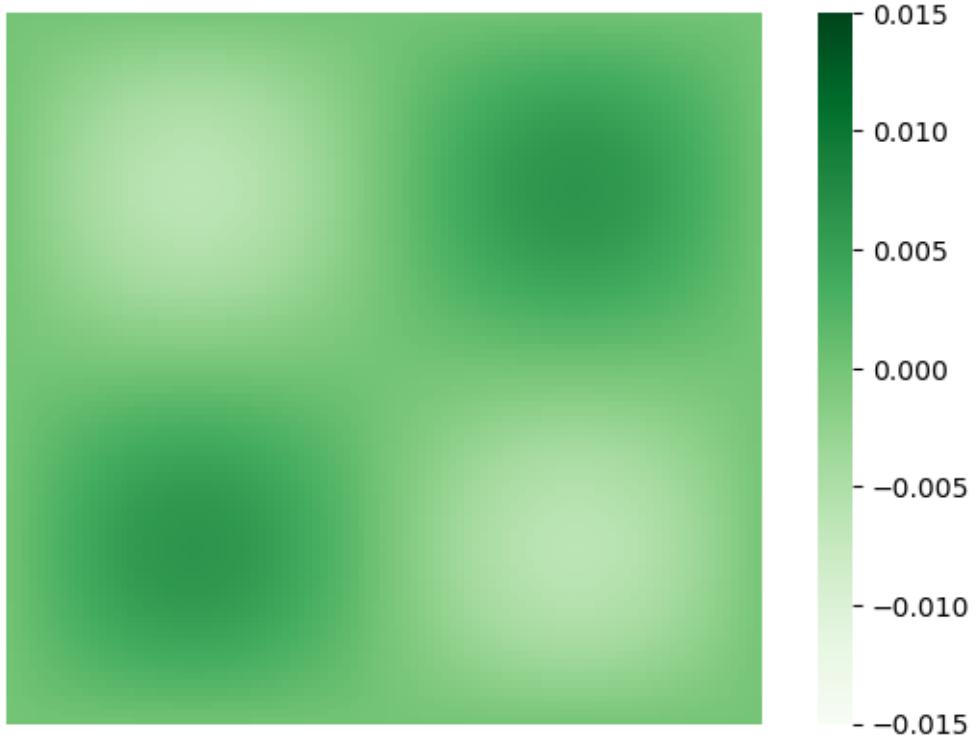
Q_4_Numerical_Solution_at_time_0.930000_.csv

Numerical Solution: Time = 0.93 s



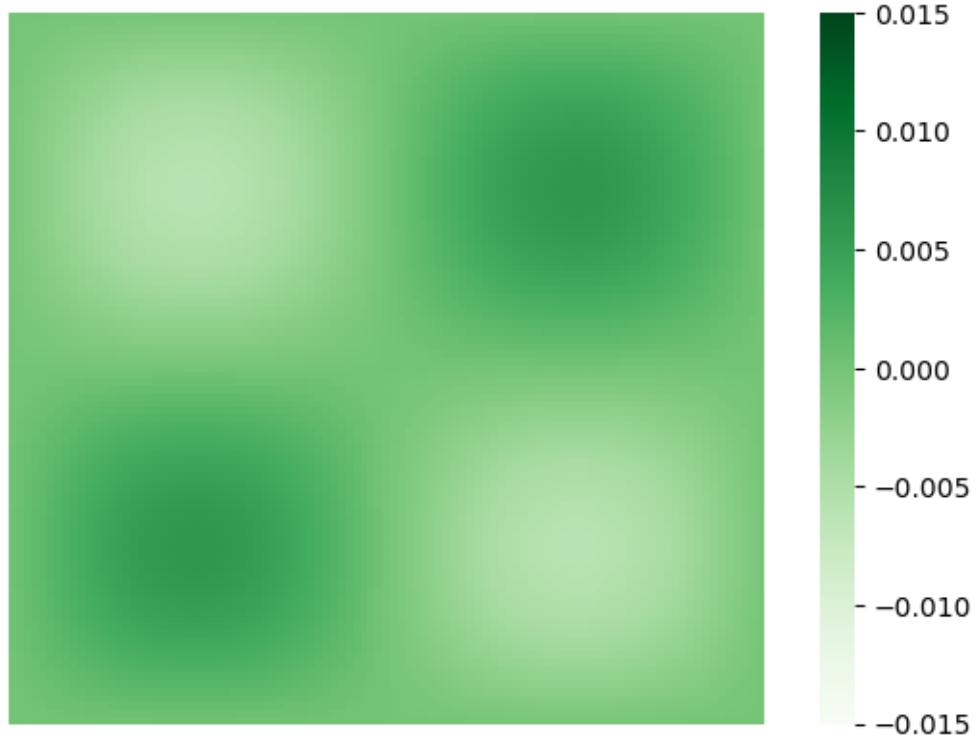
Q_4_Numerical_Solution_at_time_0.935000_.csv

Numerical Solution: Time = 0.935 s



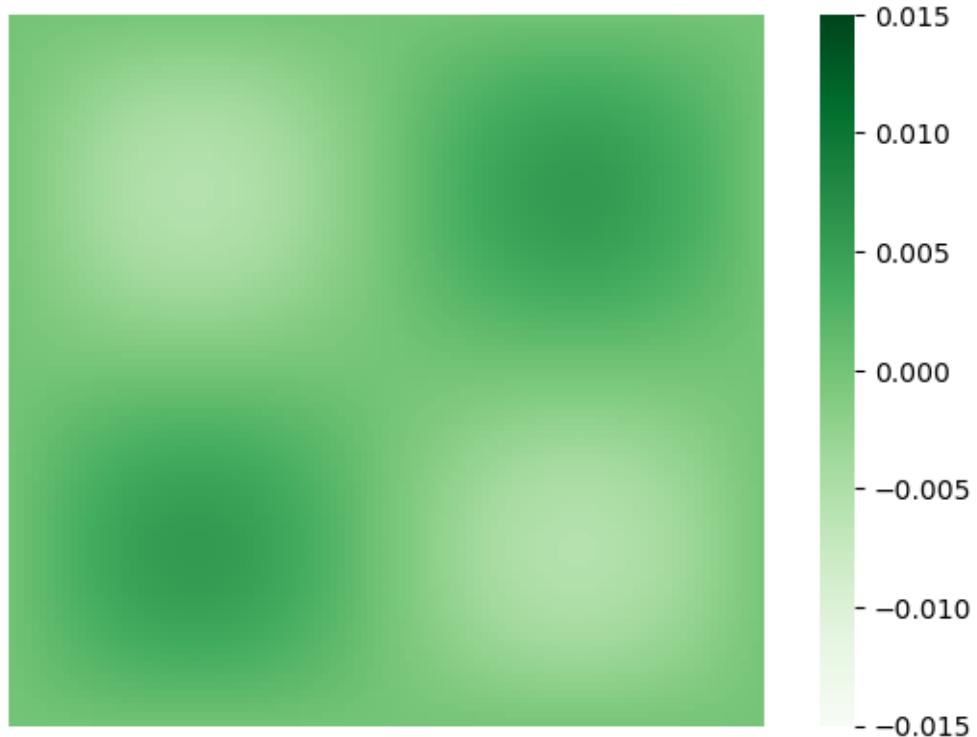
Q_4_Numerical_Solution_at_time_0.940000_.csv

Numerical Solution: Time = 0.9400000000000001 s



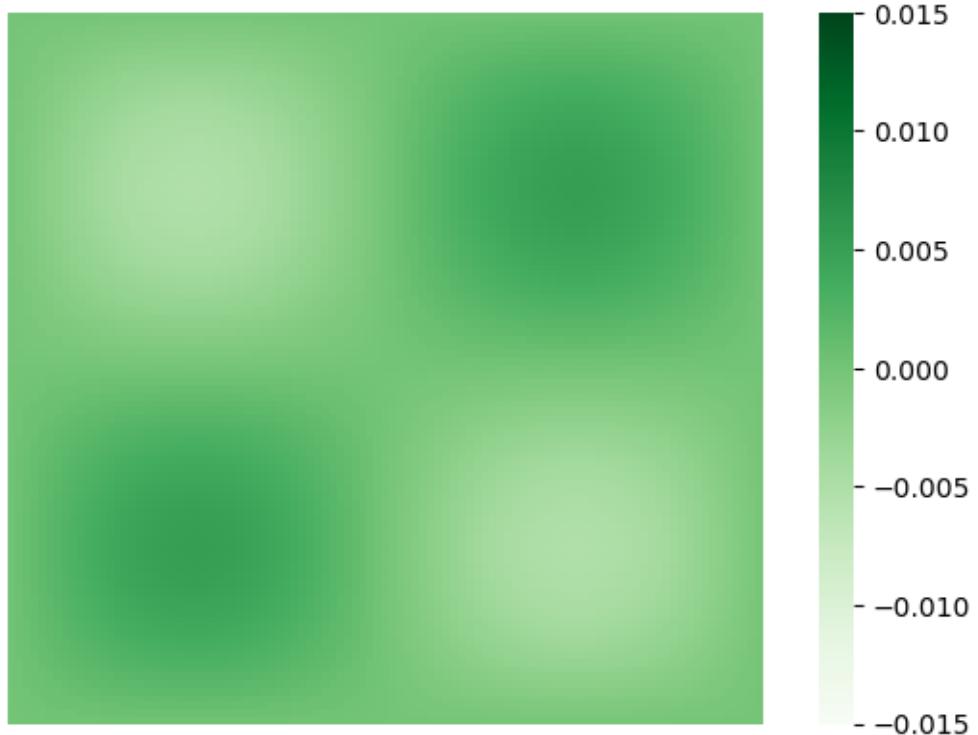
Q_4_Numerical_Solution_at_time_0.945000_.csv

Numerical Solution: Time = 0.9450000000000001 s



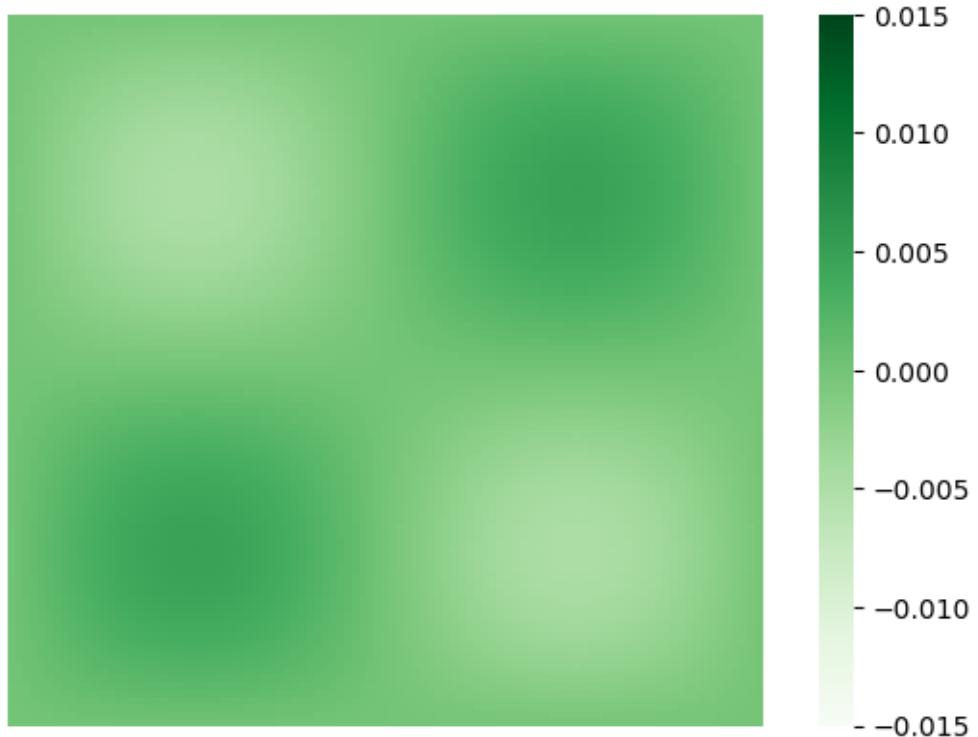
Q_4_Numerical_Solution_at_time_0.950000_.csv

Numerical Solution: Time = 0.9500000000000001 s



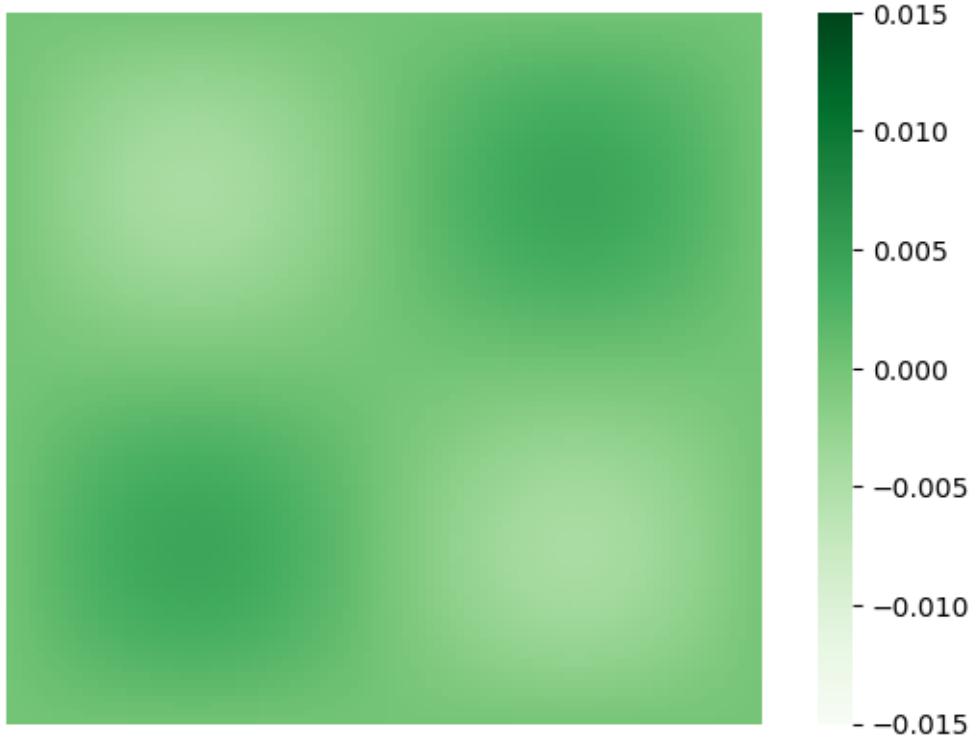
Q_4_Numerical_Solution_at_time_0.955000_.csv

Numerical Solution: Time = 0.9550000000000001 s



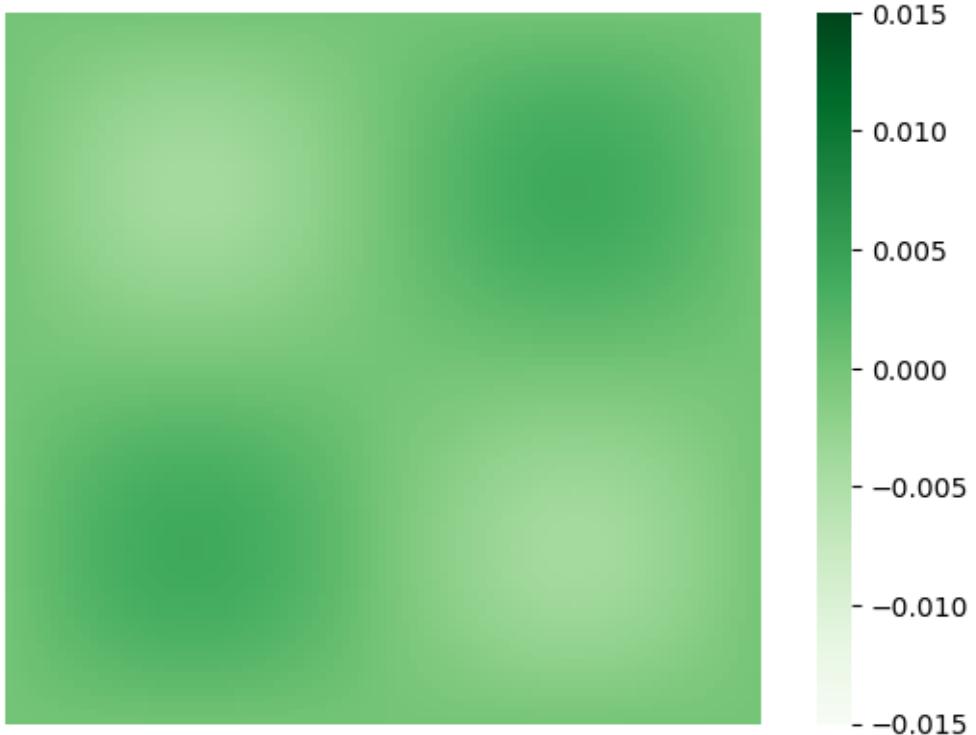
Q_4_Numerical_Solution_at_time_0.960000_.csv

Numerical Solution: Time = 0.96 s



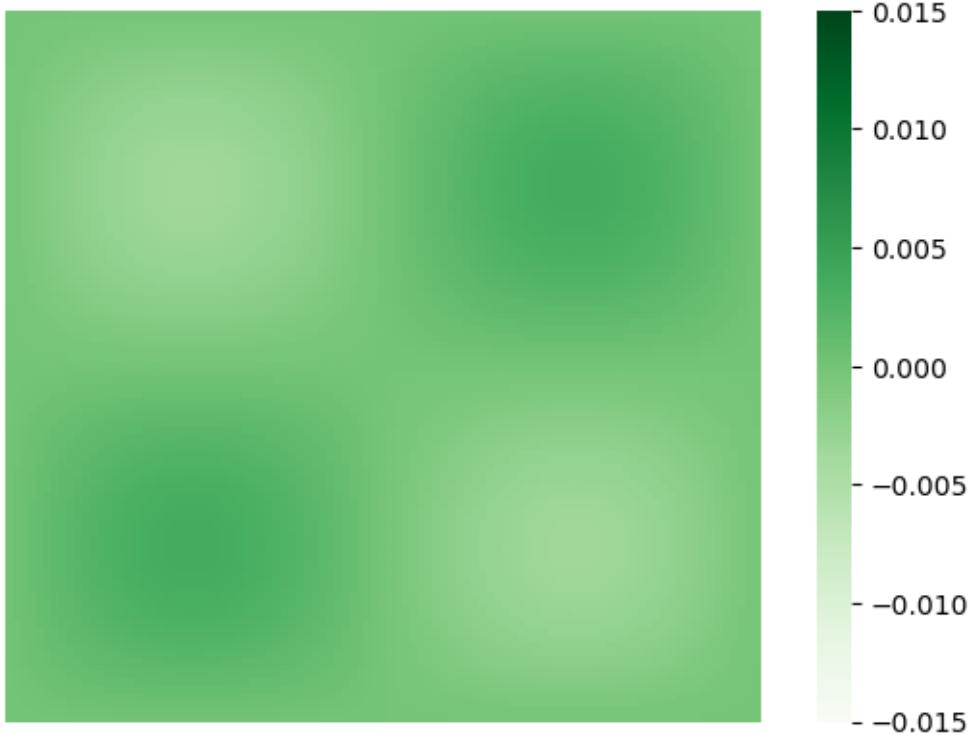
Q_4_Numerical_Solution_at_time_0.965000_.csv

Numerical Solution: Time = 0.965 s



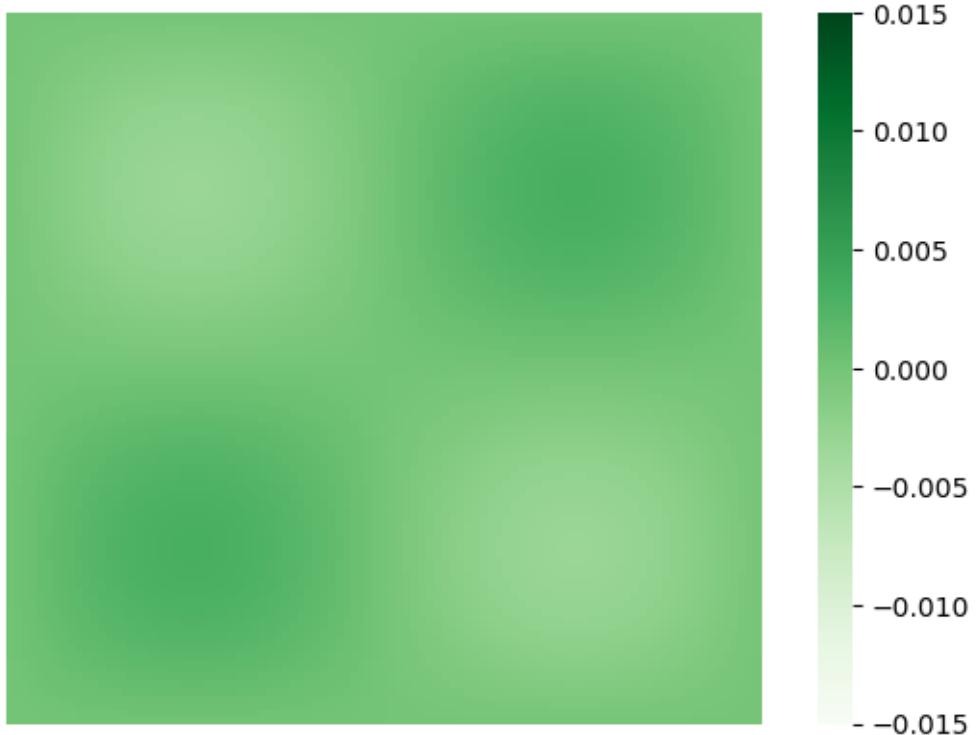
Q_4_Numerical_Solution_at_time_0.970000_.csv

Numerical Solution: Time = 0.97 s



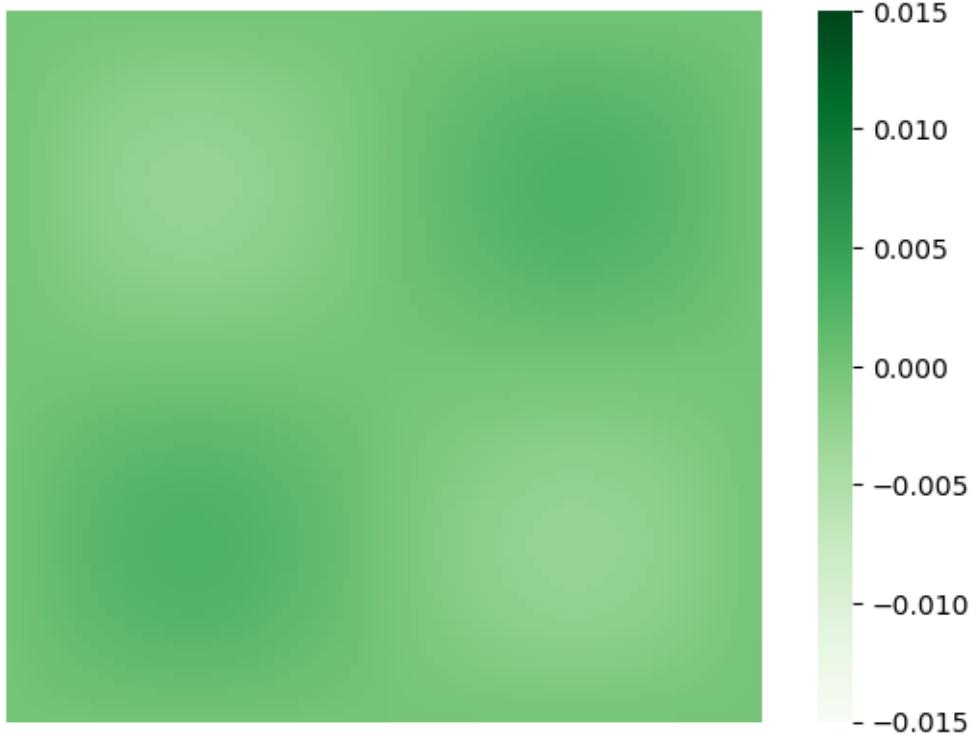
Q_4_Numerical_Solution_at_time_0.975000_.csv

Numerical Solution: Time = 0.975 s



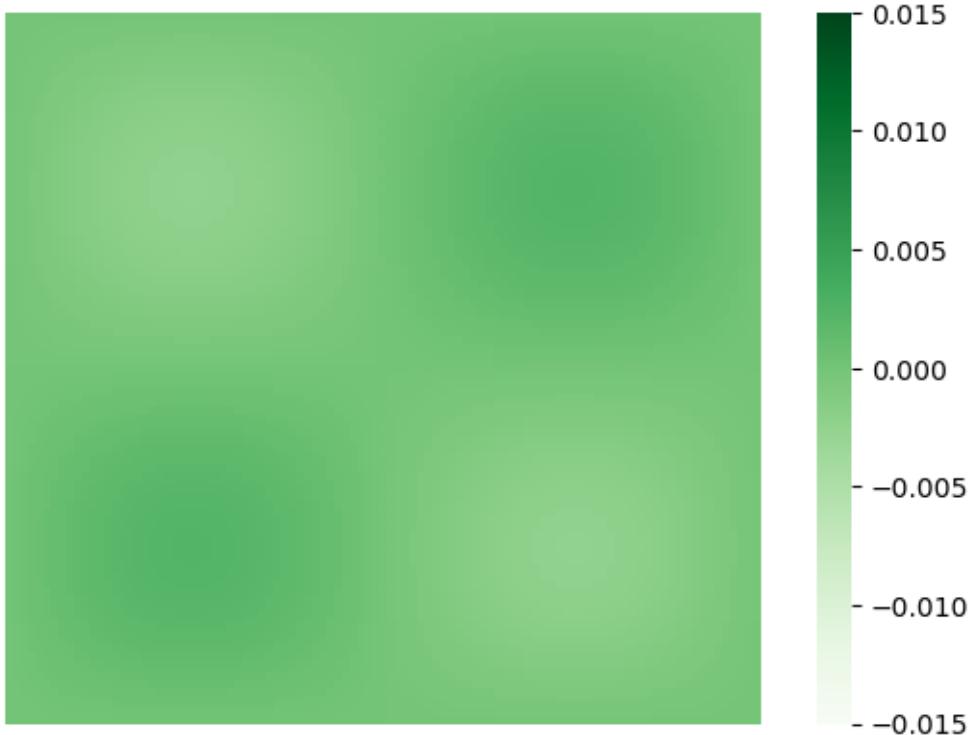
Q_4_Numerical_Solution_at_time_0.980000_.csv

Numerical Solution: Time = 0.98 s



Q_4_Numerical_Solution_at_time_0.985000_.csv

Numerical Solution: Time = 0.985 s



Q_4_Numerical_Solution_at_time_0.990000_.csv

Numerical Solution: Time = 0.99 s



Q_4_Numerical_Solution_at_time_0.995000_.csv

Numerical Solution: Time = 0.995 s



Q_4_Numerical_Solution_at_time_1.000000_.csv

```
-----  
IndexError                                                 Traceback (most recent call last)  
Cell In[3], line 12  
      10 plt.xticks([], [])  
      11 plt.yticks([], [])  
---> 12 plt.title(f"Numerical Solution: Time = {t[i]} s")  
      13 plt.show()  
      14 # hm.savefig(f"Time_{i}.png")  
  
IndexError: index 200 is out of bounds for axis 0 with size 200
```



```
[4]: Output_file_names = pd.read_csv("Analytical_Output_file_names.csv",header=None)
Output_file_names
```

```
[4]:          0
0    Q_4_Analytical_Solution_at_time_0.000000_.csv
1    Q_4_Analytical_Solution_at_time_0.005000_.csv
2    Q_4_Analytical_Solution_at_time_0.010000_.csv
3    Q_4_Analytical_Solution_at_time_0.015000_.csv
4    Q_4_Analytical_Solution_at_time_0.020000_.csv
..
       ...
196   Q_4_Analytical_Solution_at_time_0.980000_.csv
197   Q_4_Analytical_Solution_at_time_0.985000_.csv
198   Q_4_Analytical_Solution_at_time_0.990000_.csv
199   Q_4_Analytical_Solution_at_time_0.995000_.csv
200   Q_4_Analytical_Solution_at_time_1.000000_.csv
```

[201 rows x 1 columns]

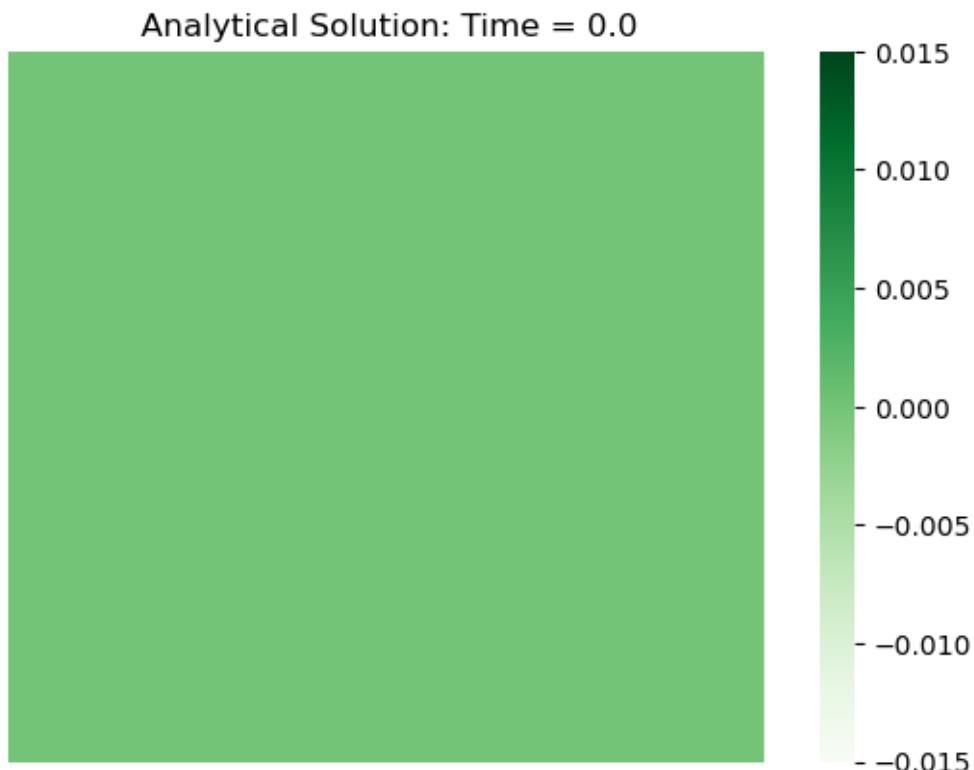
```
[5]: Image = []
t = np.arange(0,1,0.005)
for i,file_name in enumerate(Output_file_names.to_numpy().astype("str")):
    print(file_name[0])
    Numerical = pd.read_csv(file_name[0],header=None).to_numpy()
```

```

hm = sns.heatmap(Numerical,cmap='Greens',vmin=-0.015,vmax=0.015)
x_ticks = np.linspace(0,1,10)
y_ticks = np.linspace(0,1,10)
plt.xticks([],[])
plt.yticks([],[])
plt.title(f"Analytical Solution: Time = {t[i]}")
plt.show()
# hm.savefig(f"Time_{i}.png")
figure = hm.get_figure()
figure.savefig(f'Analytical_Time_{t[i]}.png', dpi=400)
Image.append(f'Analytical_Time_{t[i]}.png')

```

Q_4_Analytical_Solution_at_time_0.000000_.csv



Q_4_Analytical_Solution_at_time_0.005000_.csv

Analytical Solution: Time = 0.005



Q_4_Analytical_Solution_at_time_0.010000_.csv

Analytical Solution: Time = 0.01



Q_4_Analytical_Solution_at_time_0.015000_.csv

Analytical Solution: Time = 0.015



Q_4_Analytical_Solution_at_time_0.020000_.csv

Analytical Solution: Time = 0.02



Q_4_Analytical_Solution_at_time_0.025000_.csv

Analytical Solution: Time = 0.025



Q_4_Analytical_Solution_at_time_0.030000_.csv

Analytical Solution: Time = 0.03



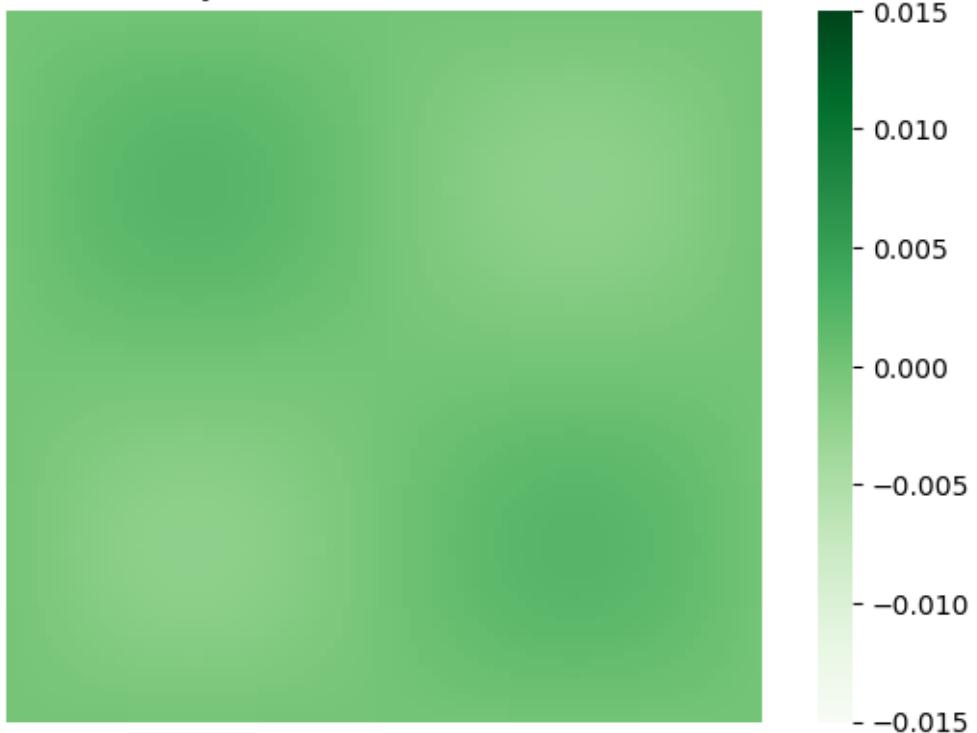
Q_4_Analytical_Solution_at_time_0.035000_.csv

Analytical Solution: Time = 0.035



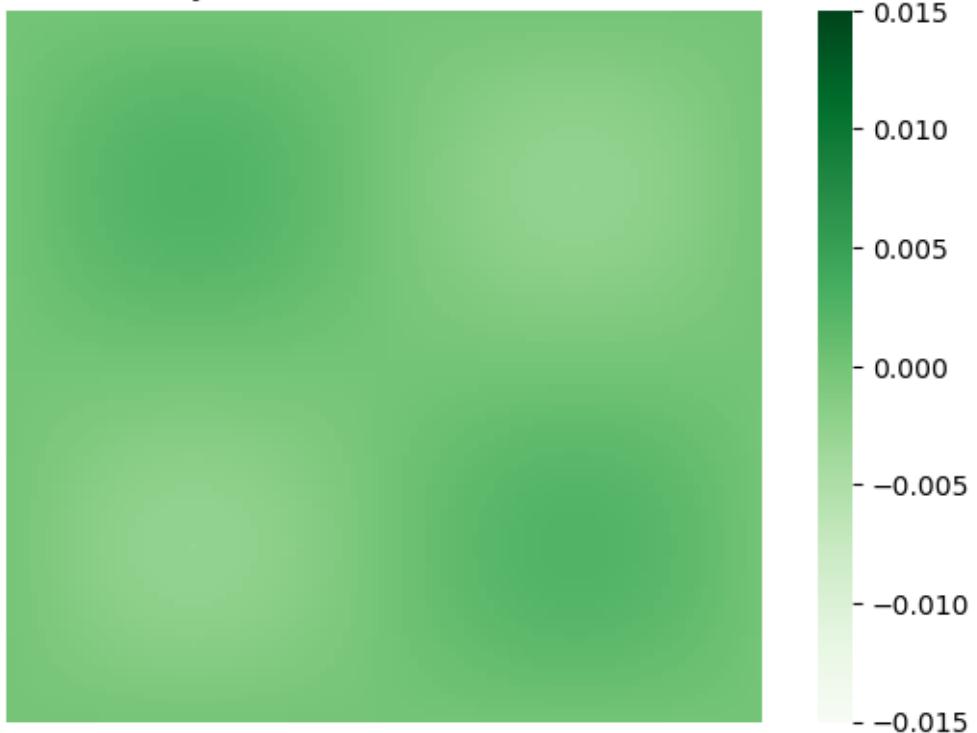
Q_4_Analytical_Solution_at_time_0.040000_.csv

Analytical Solution: Time = 0.04



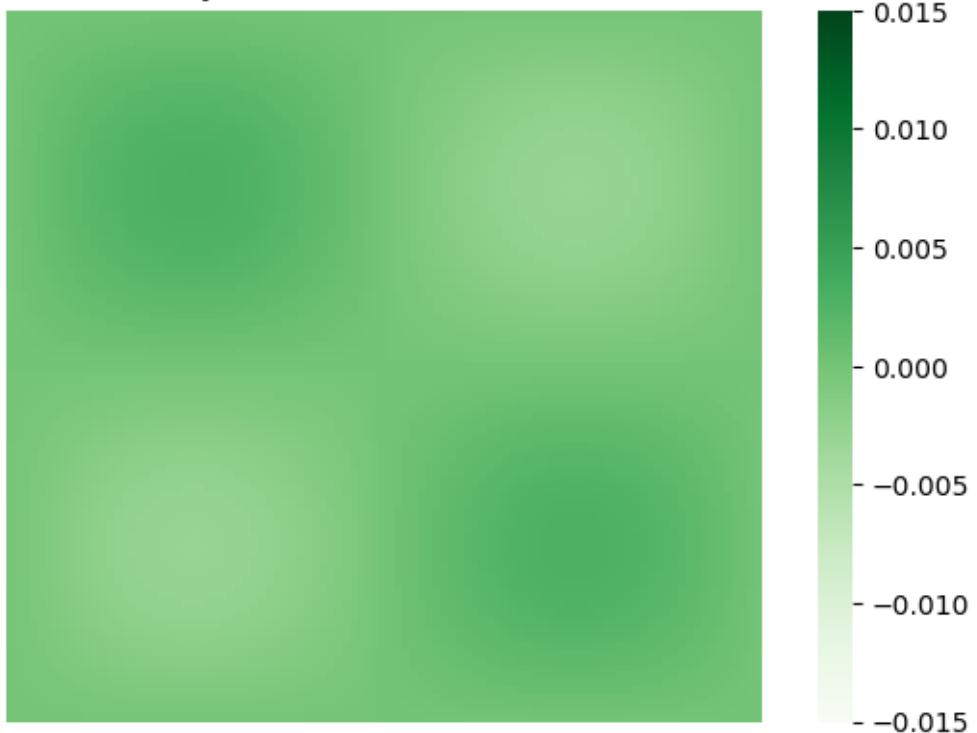
Q_4_Analytical_Solution_at_time_0.045000_.csv

Analytical Solution: Time = 0.045



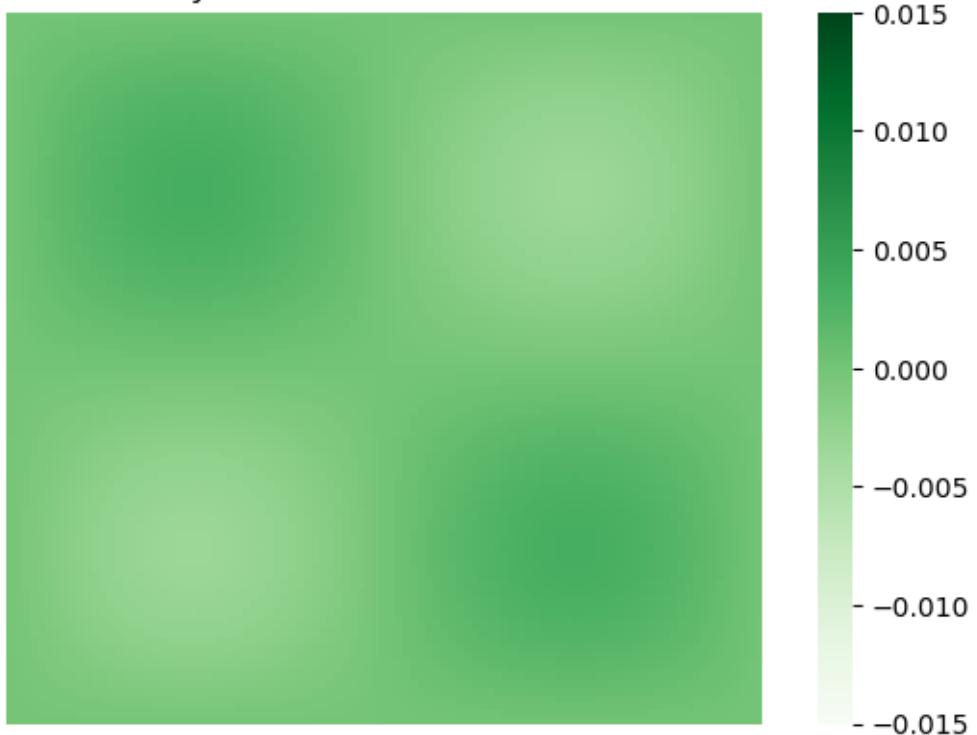
Q_4_Analytical_Solution_at_time_0.050000_.csv

Analytical Solution: Time = 0.05



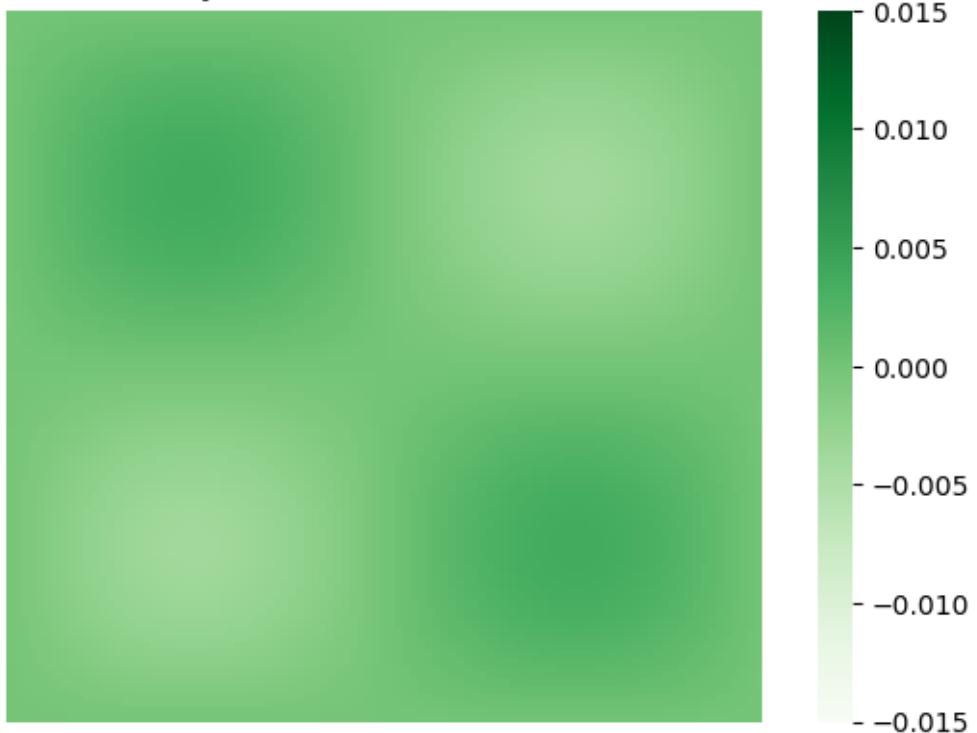
Q_4_Analytical_Solution_at_time_0.055000_.csv

Analytical Solution: Time = 0.055



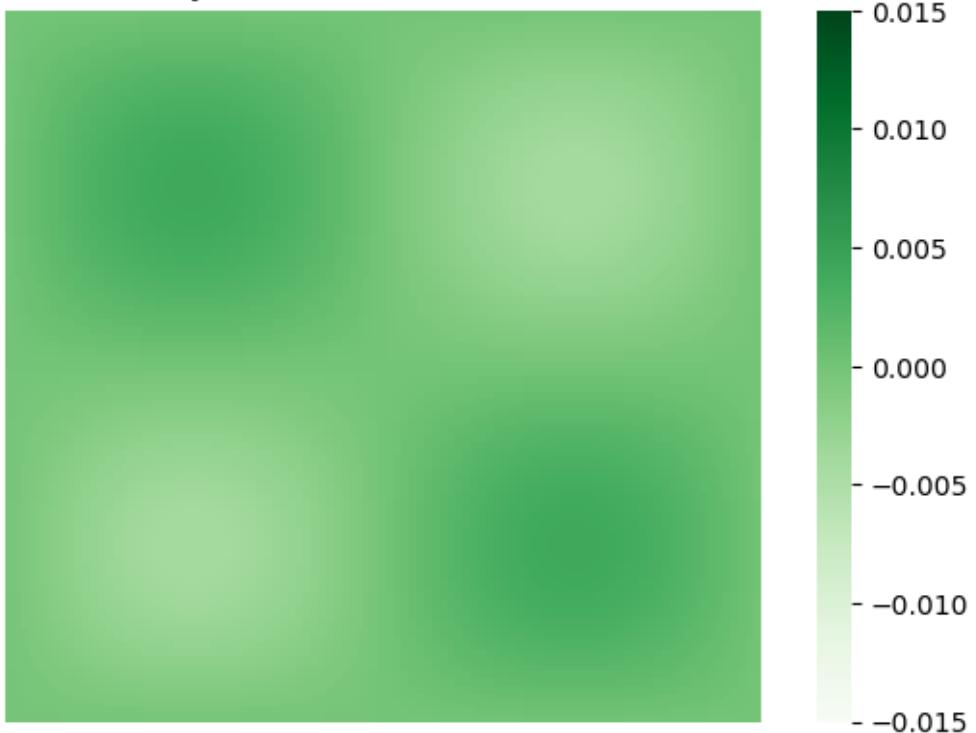
Q_4_Analytical_Solution_at_time_0.060000_.csv

Analytical Solution: Time = 0.06



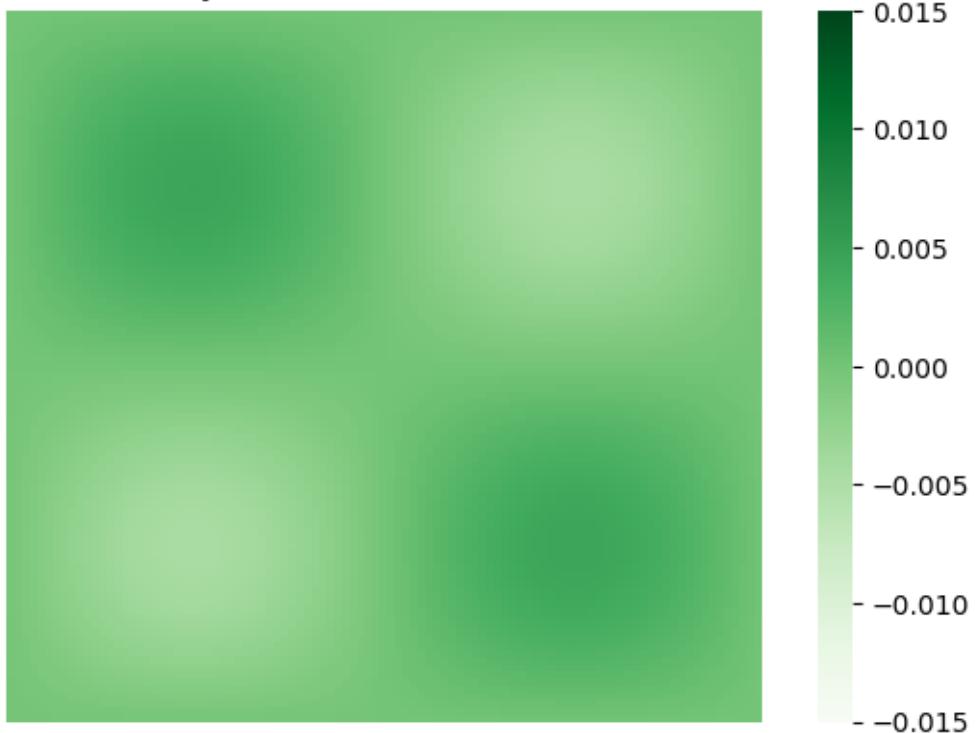
Q_4_Analytical_Solution_at_time_0.065000_.csv

Analytical Solution: Time = 0.065



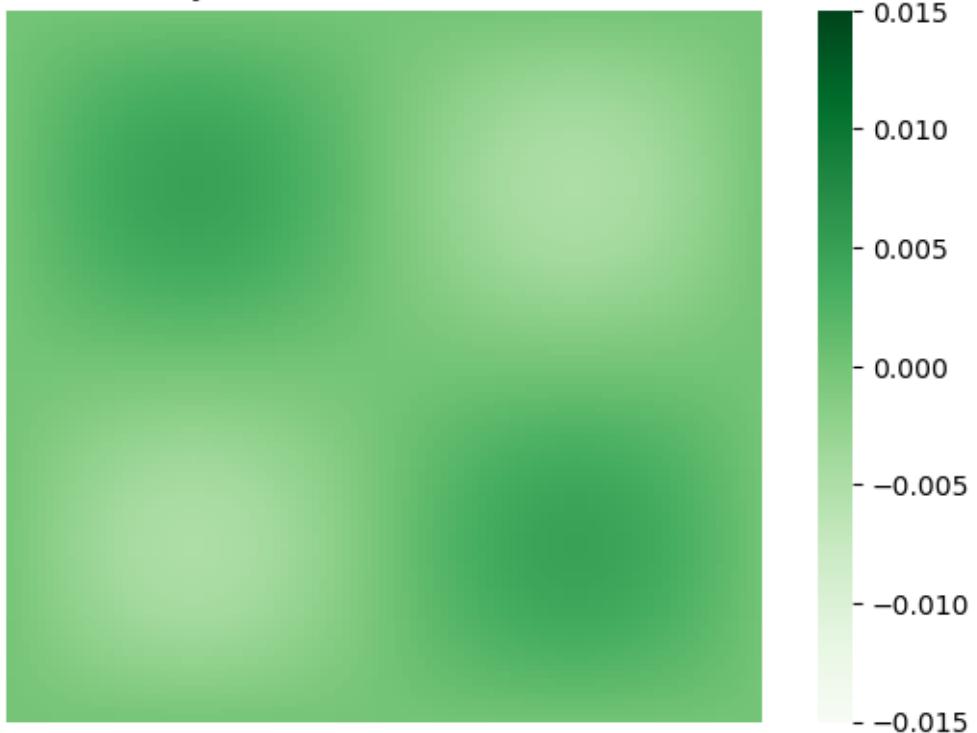
Q_4_Analytical_Solution_at_time_0.070000_.csv

Analytical Solution: Time = 0.07



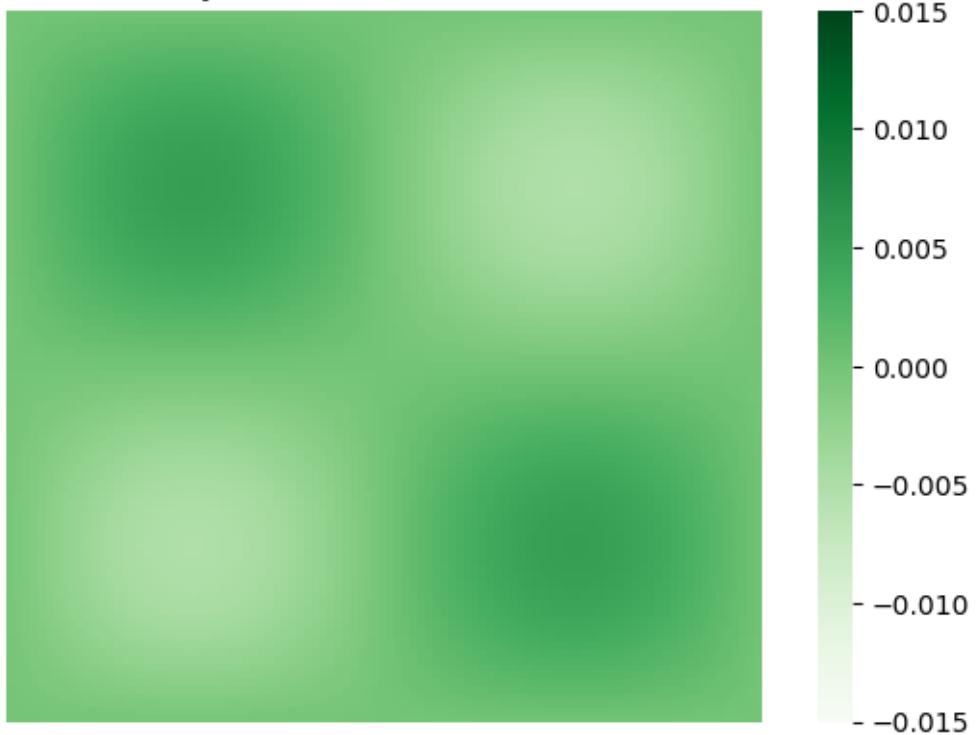
Q_4_Analytical_Solution_at_time_0.075000_.csv

Analytical Solution: Time = 0.075



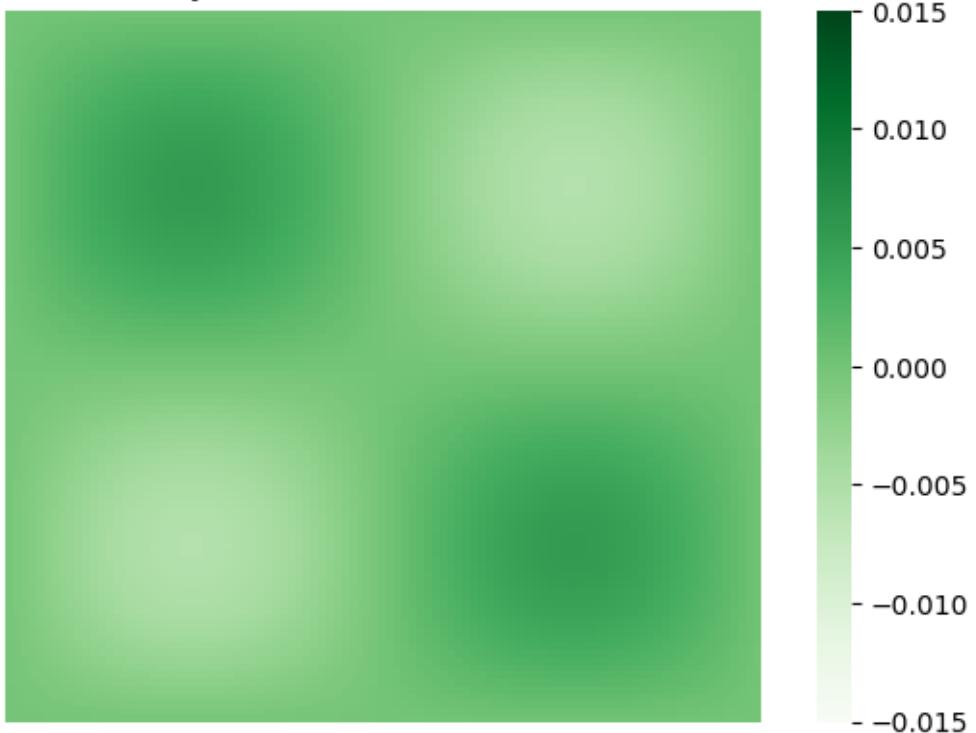
Q_4_Analytical_Solution_at_time_0.080000_.csv

Analytical Solution: Time = 0.08



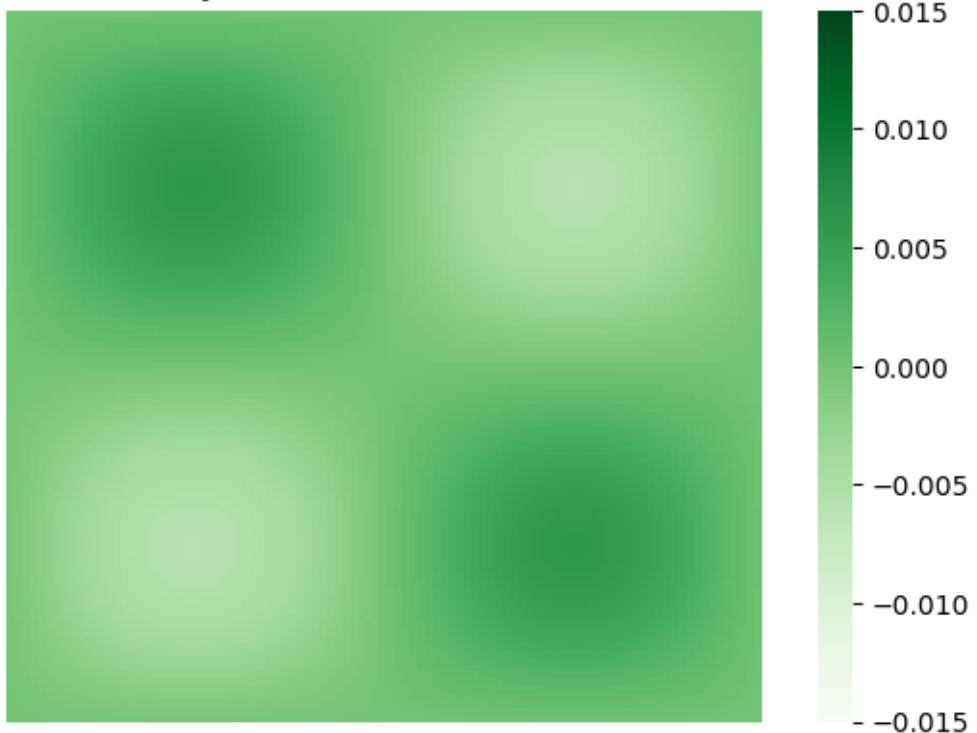
Q_4_Analytical_Solution_at_time_0.085000_.csv

Analytical Solution: Time = 0.085



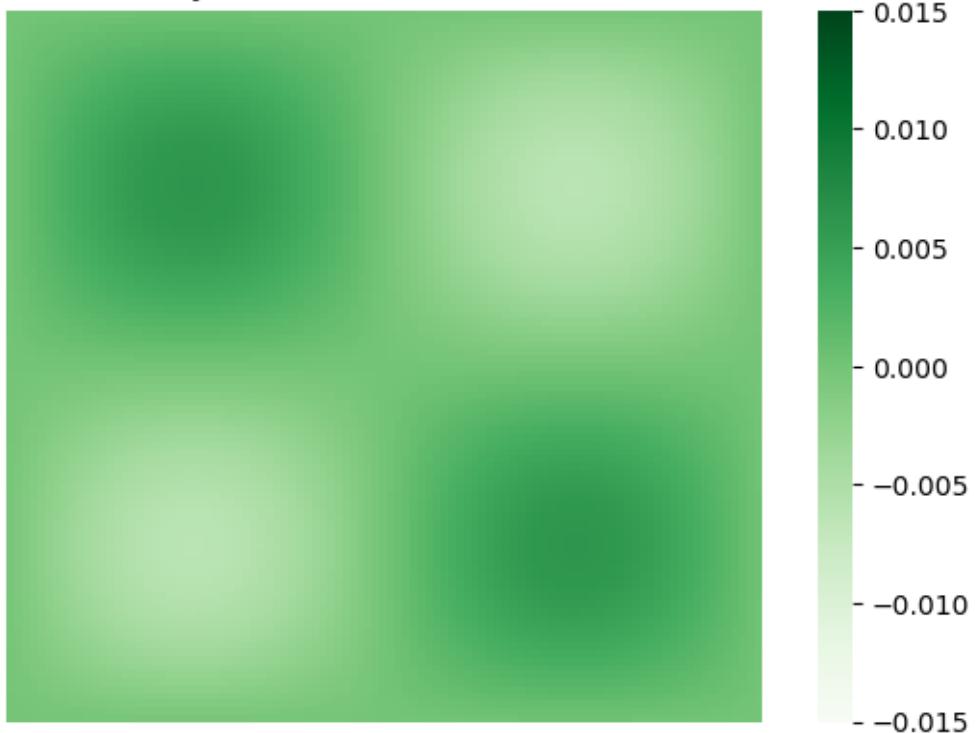
Q_4_Analytical_Solution_at_time_0.090000_.csv

Analytical Solution: Time = 0.09



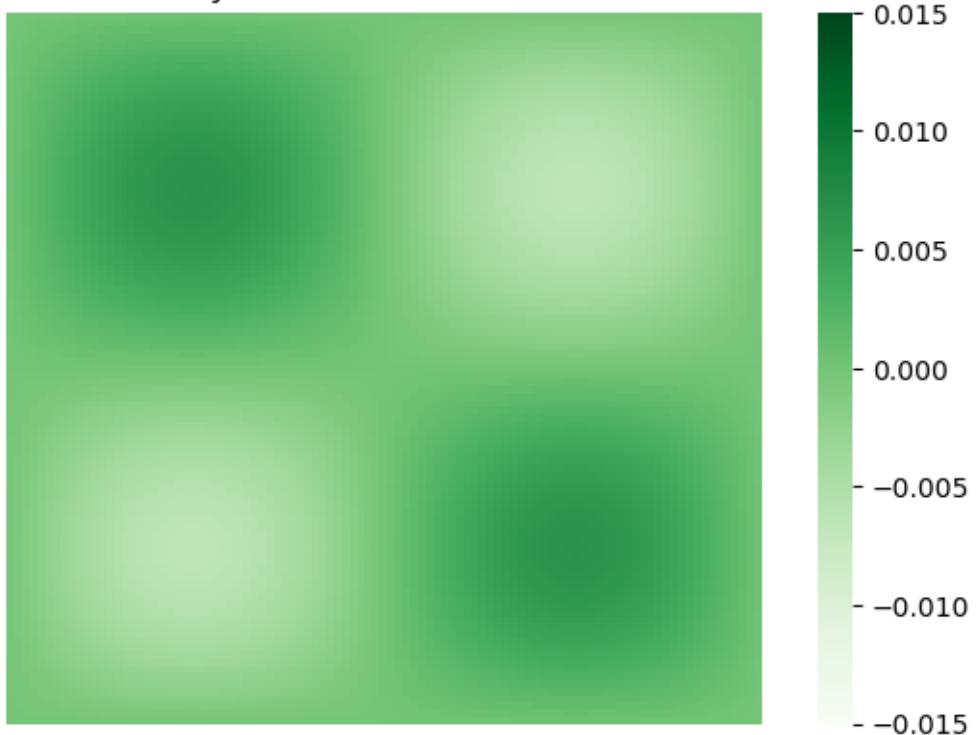
Q_4_Analytical_Solution_at_time_0.095000_.csv

Analytical Solution: Time = 0.095



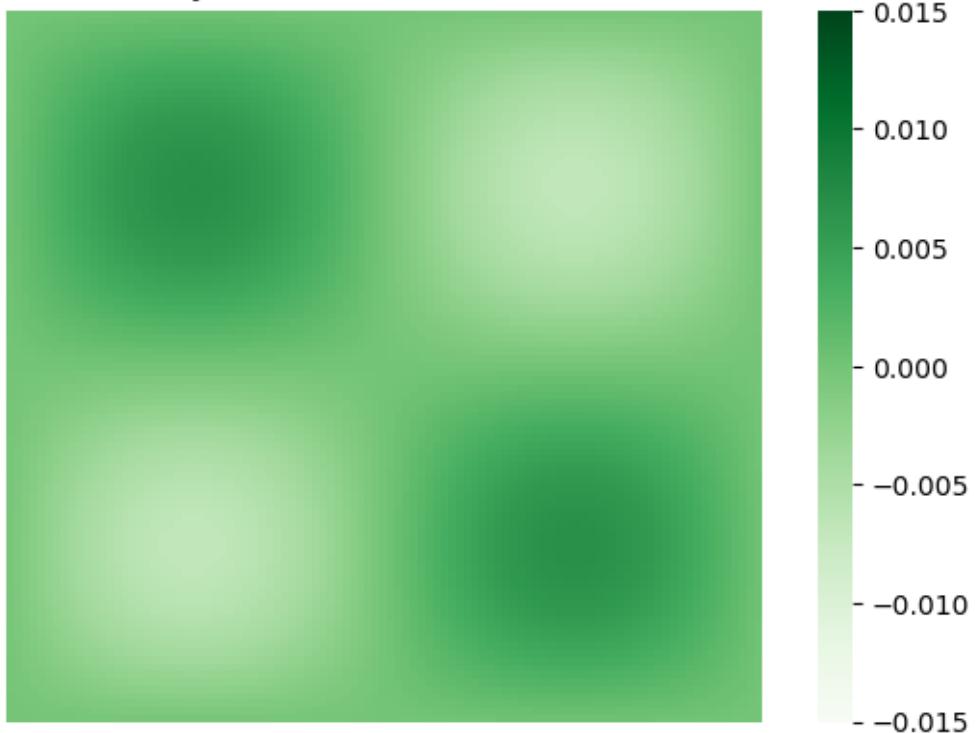
Q_4_Analytical_Solution_at_time_0.100000_.csv

Analytical Solution: Time = 0.1



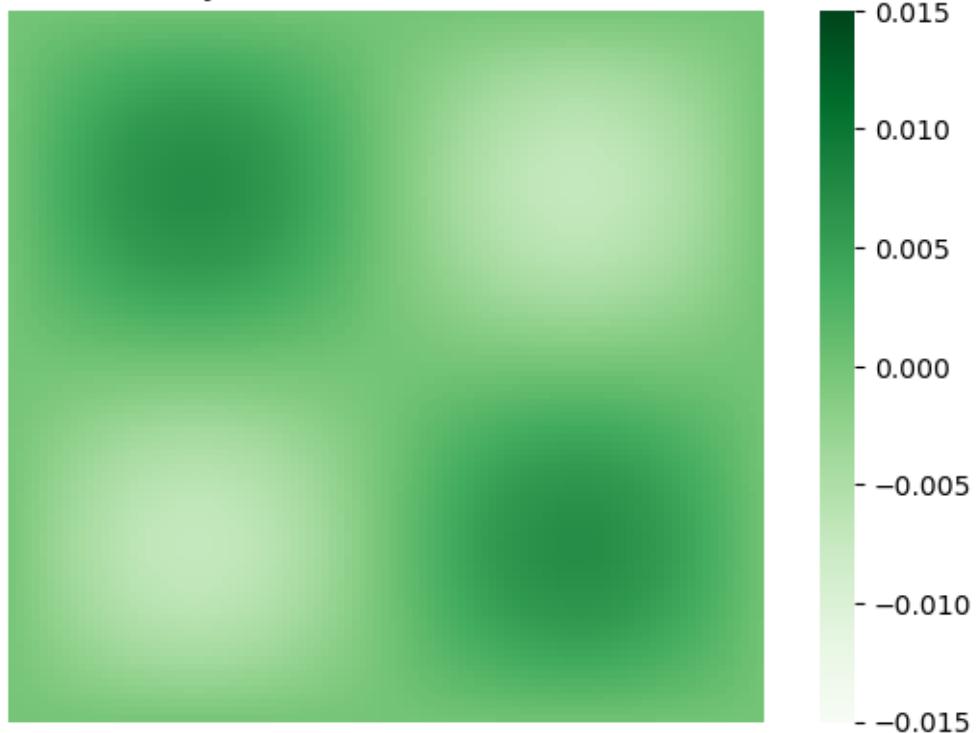
Q_4_Analytical_Solution_at_time_0.105000_.csv

Analytical Solution: Time = 0.105



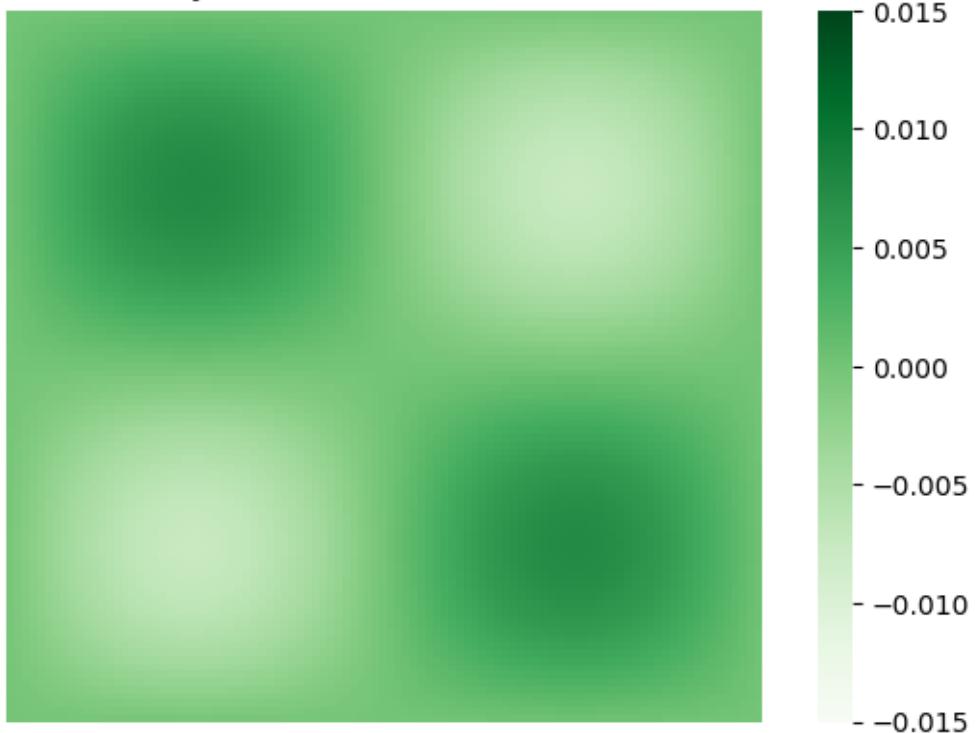
Q_4_Analytical_Solution_at_time_0.110000_.csv

Analytical Solution: Time = 0.11



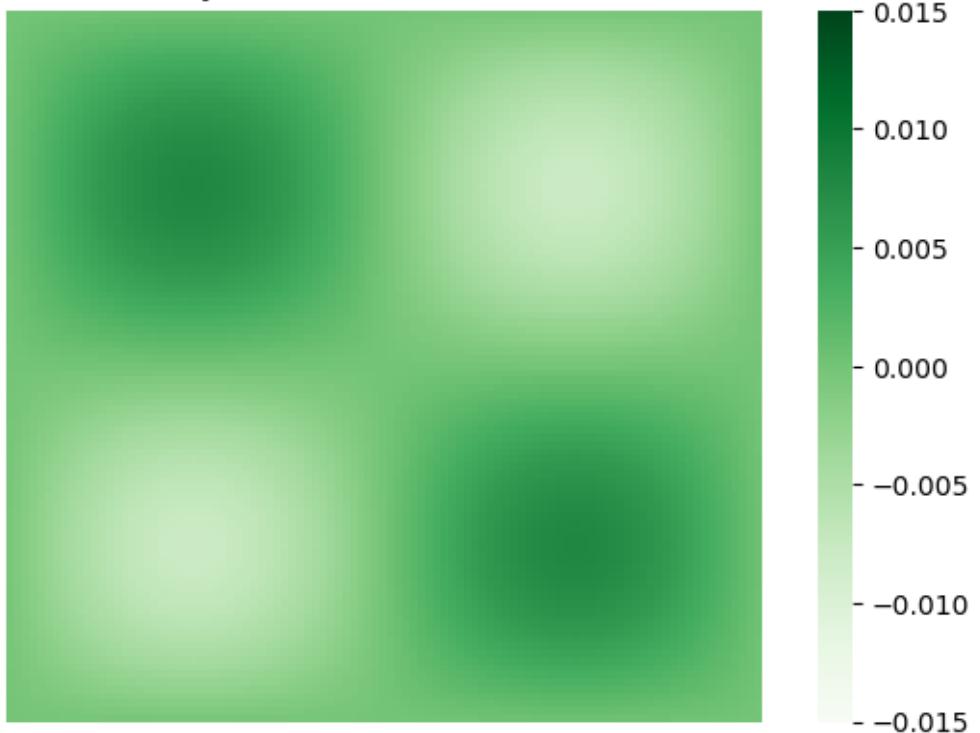
Q_4_Analytical_Solution_at_time_0.115000_.csv

Analytical Solution: Time = 0.115



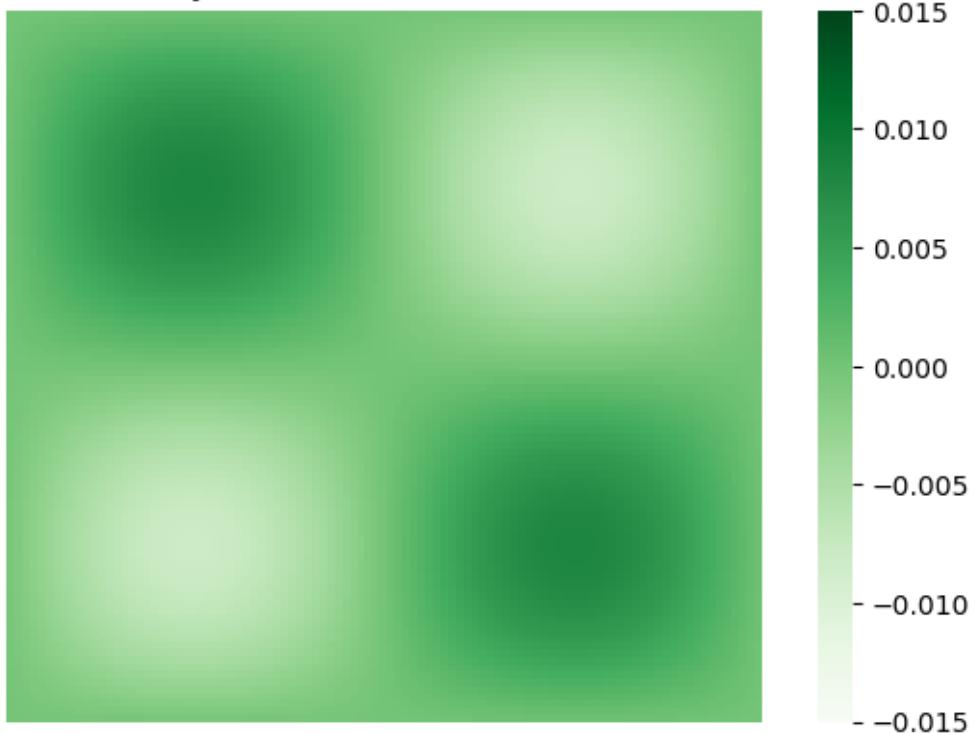
Q_4_Analytical_Solution_at_time_0.120000_.csv

Analytical Solution: Time = 0.12



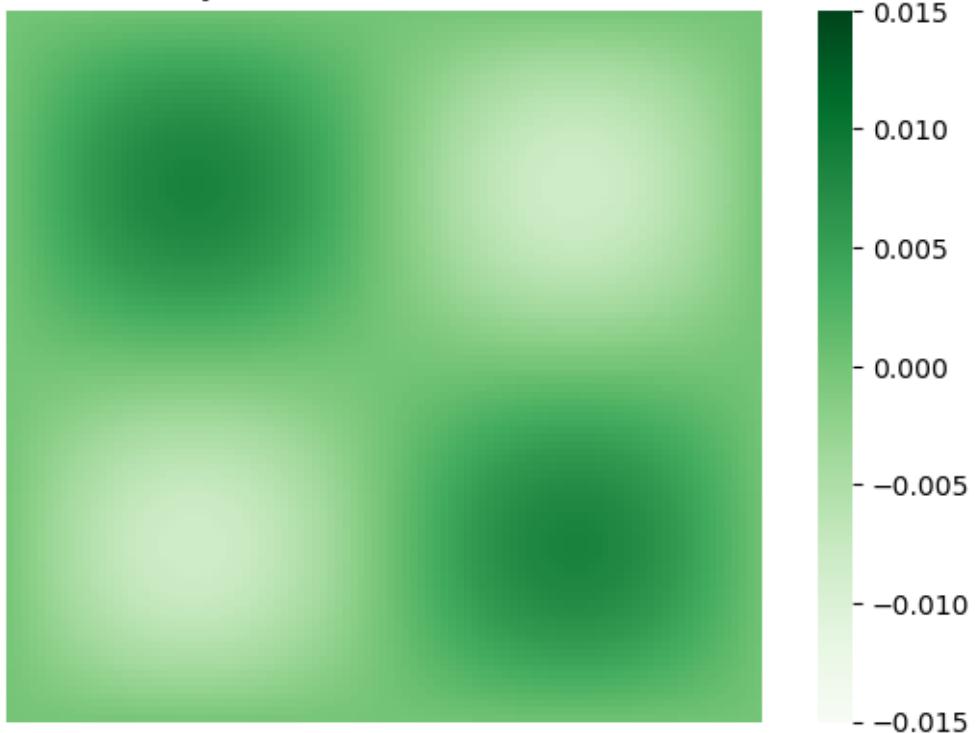
Q_4_Analytical_Solution_at_time_0.125000_.csv

Analytical Solution: Time = 0.125



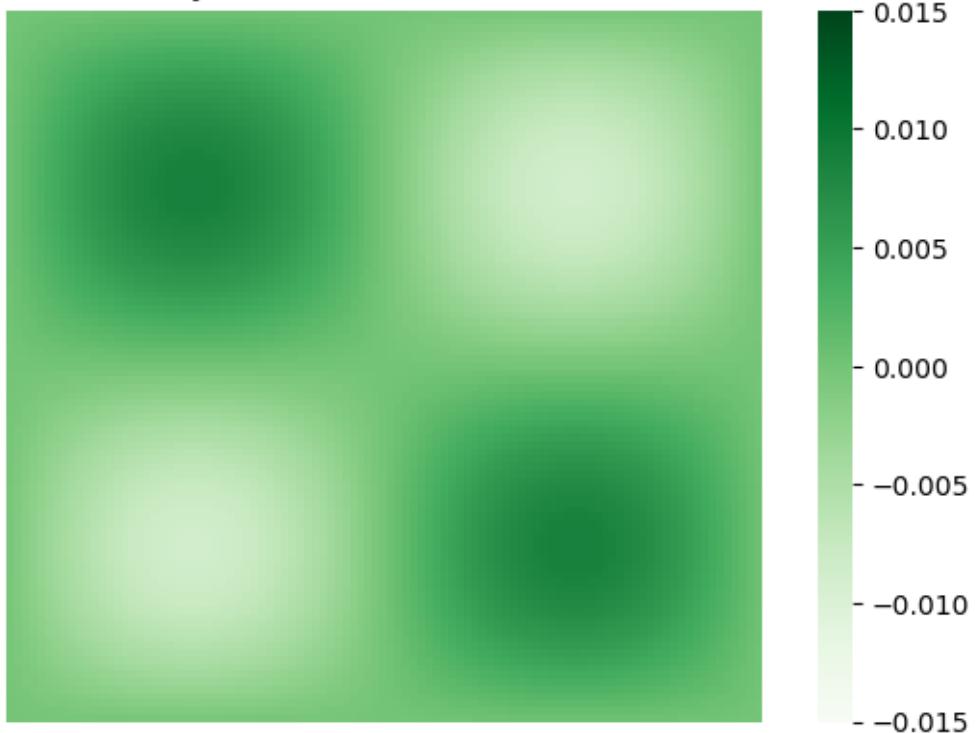
Q_4_Analytical_Solution_at_time_0.130000_.csv

Analytical Solution: Time = 0.13



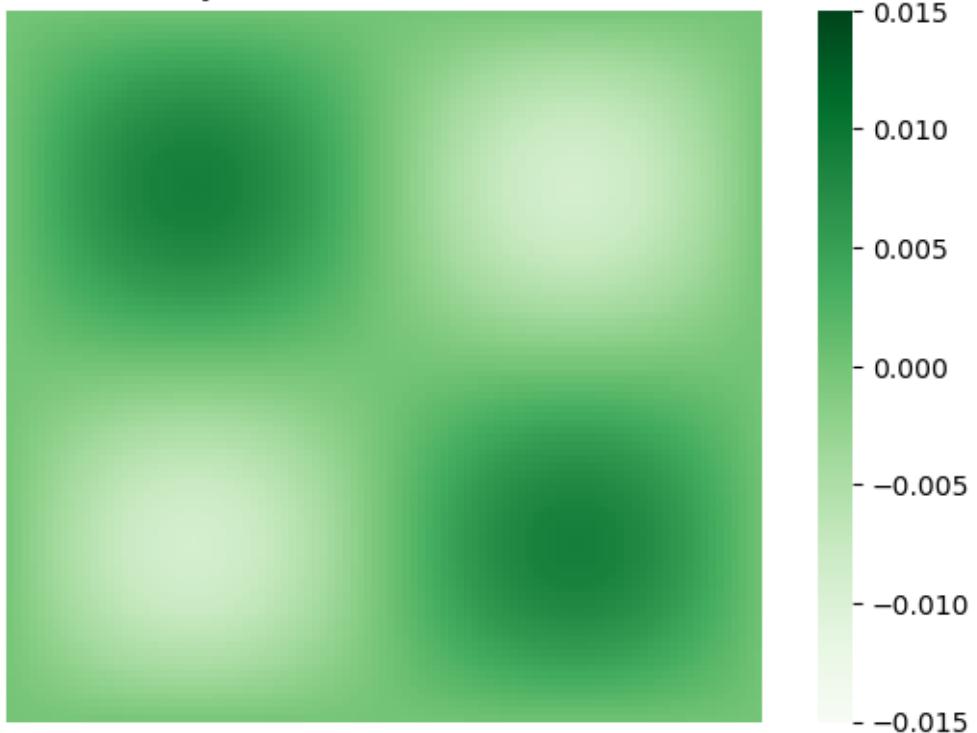
Q_4_Analytical_Solution_at_time_0.135000_.csv

Analytical Solution: Time = 0.135



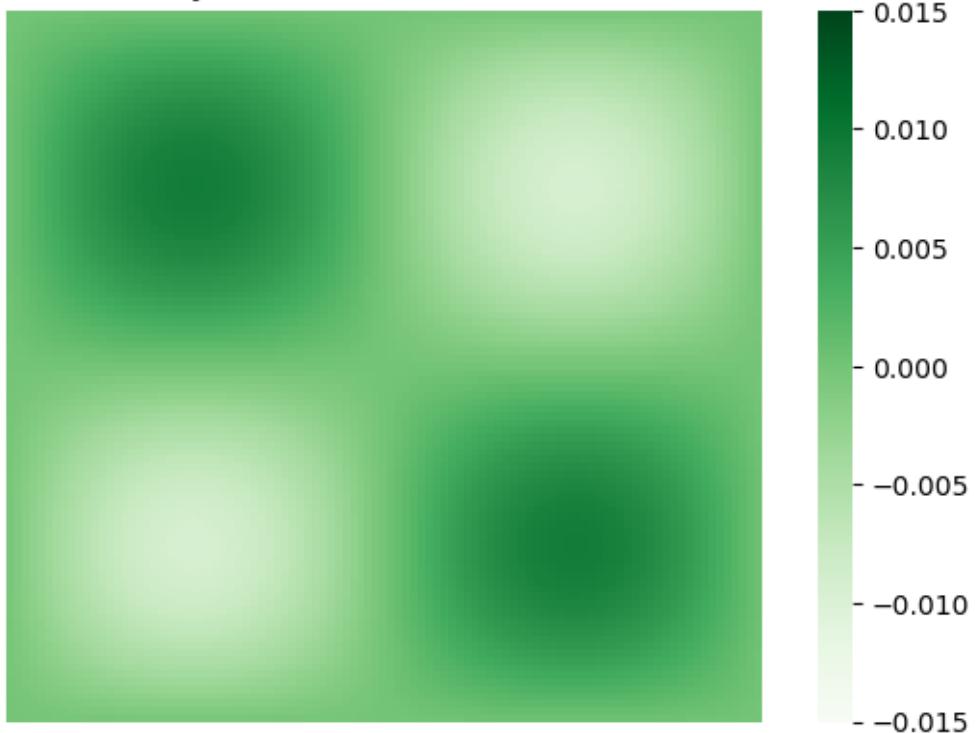
Q_4_Analytical_Solution_at_time_0.140000_.csv

Analytical Solution: Time = 0.14



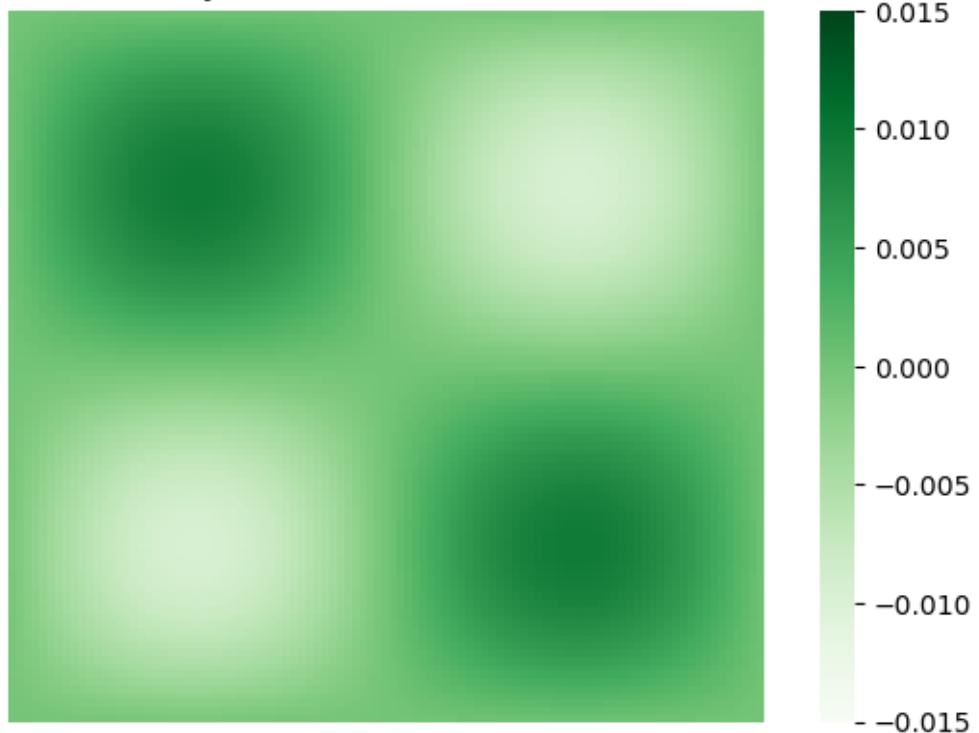
Q_4_Analytical_Solution_at_time_0.145000_.csv

Analytical Solution: Time = 0.145



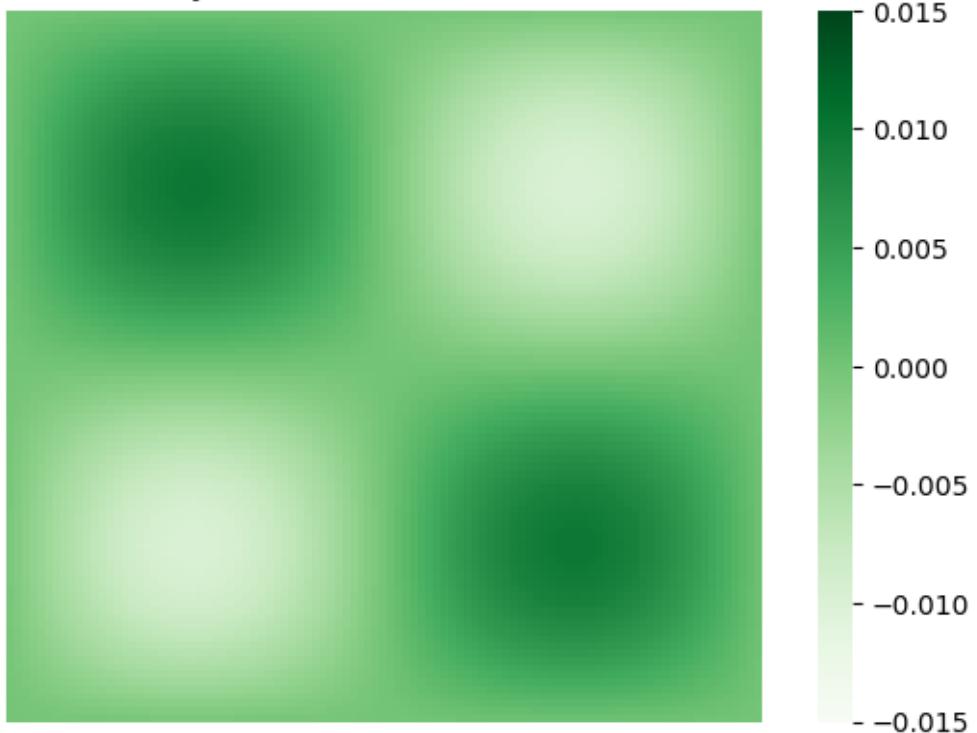
Q_4_Analytical_Solution_at_time_0.150000_.csv

Analytical Solution: Time = 0.15



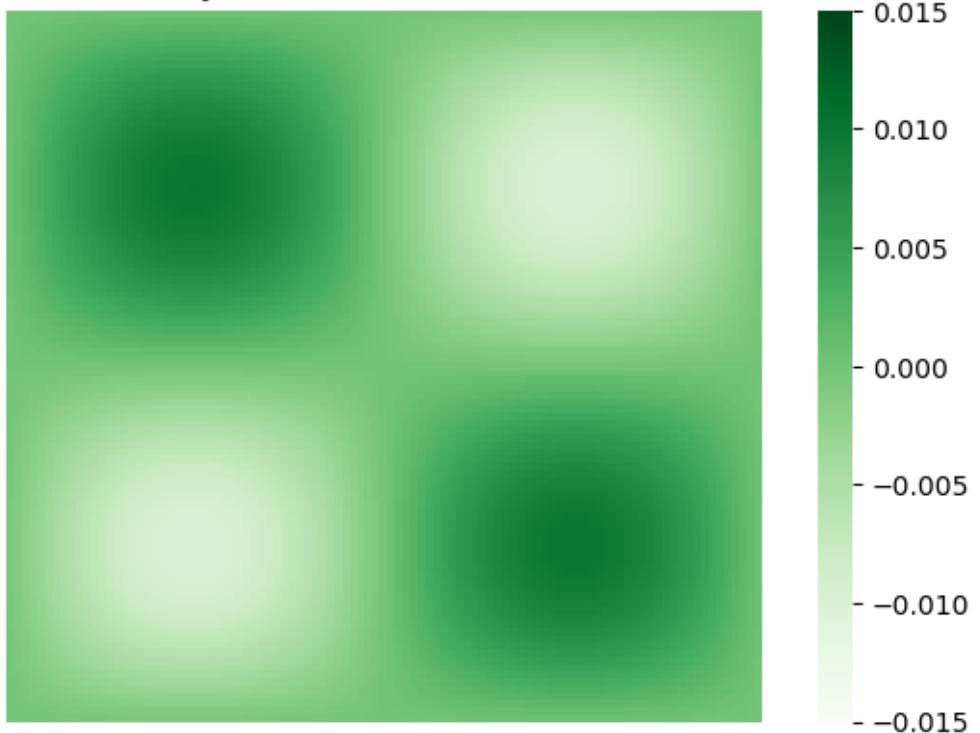
Q_4_Analytical_Solution_at_time_0.155000_.csv

Analytical Solution: Time = 0.155



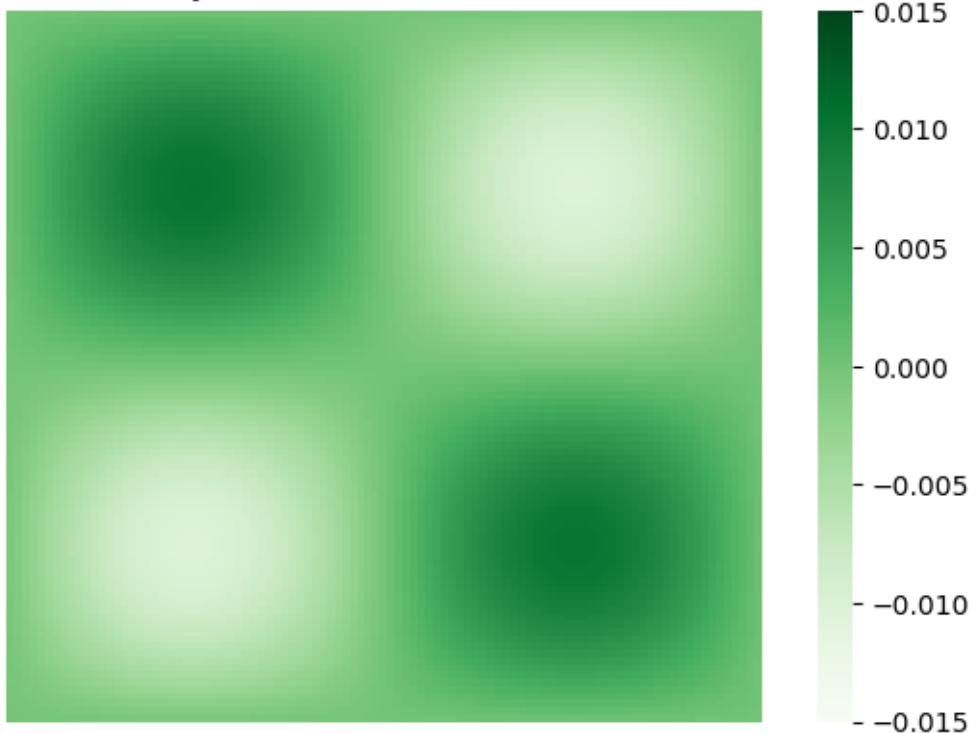
Q_4_Analytical_Solution_at_time_0.160000_.csv

Analytical Solution: Time = 0.16



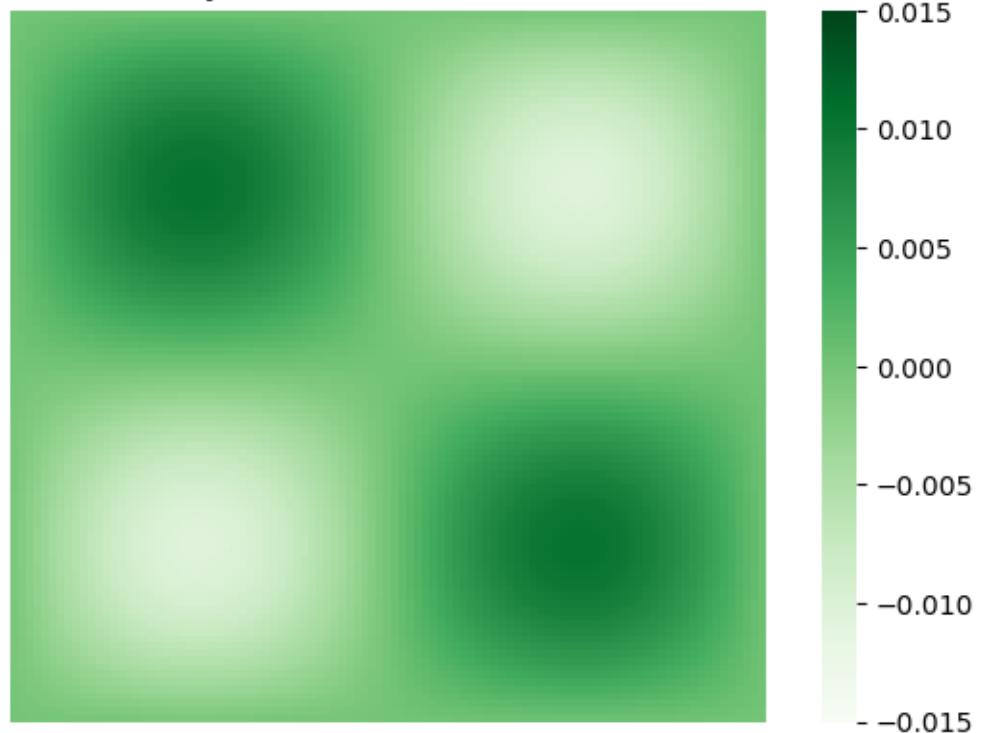
Q_4_Analytical_Solution_at_time_0.165000_.csv

Analytical Solution: Time = 0.165



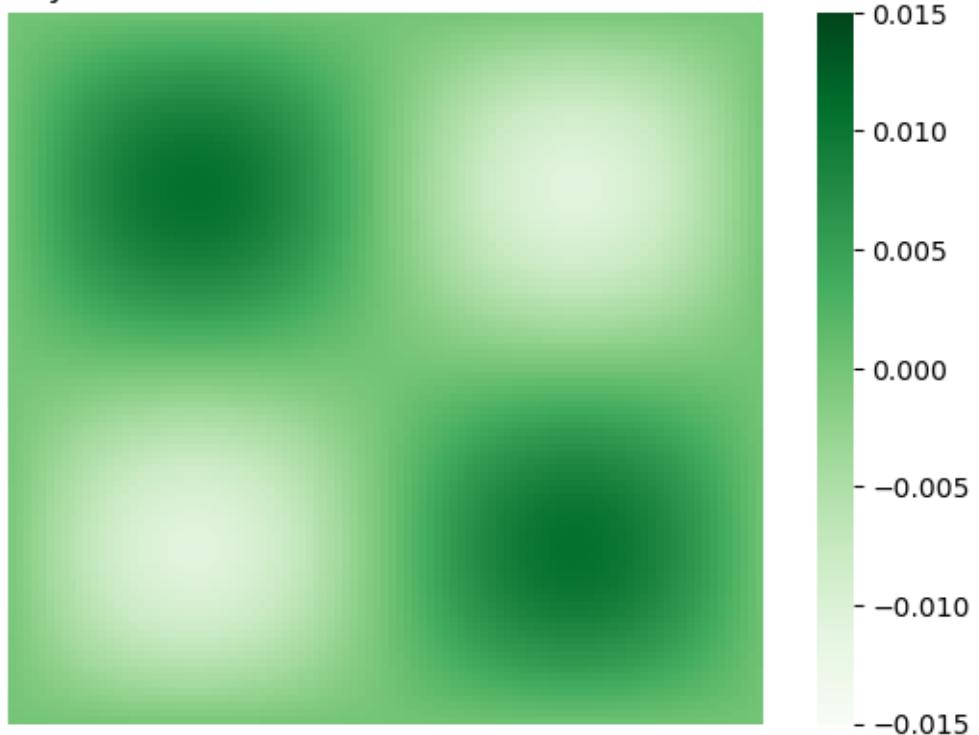
Q_4_Analytical_Solution_at_time_0.170000_.csv

Analytical Solution: Time = 0.17



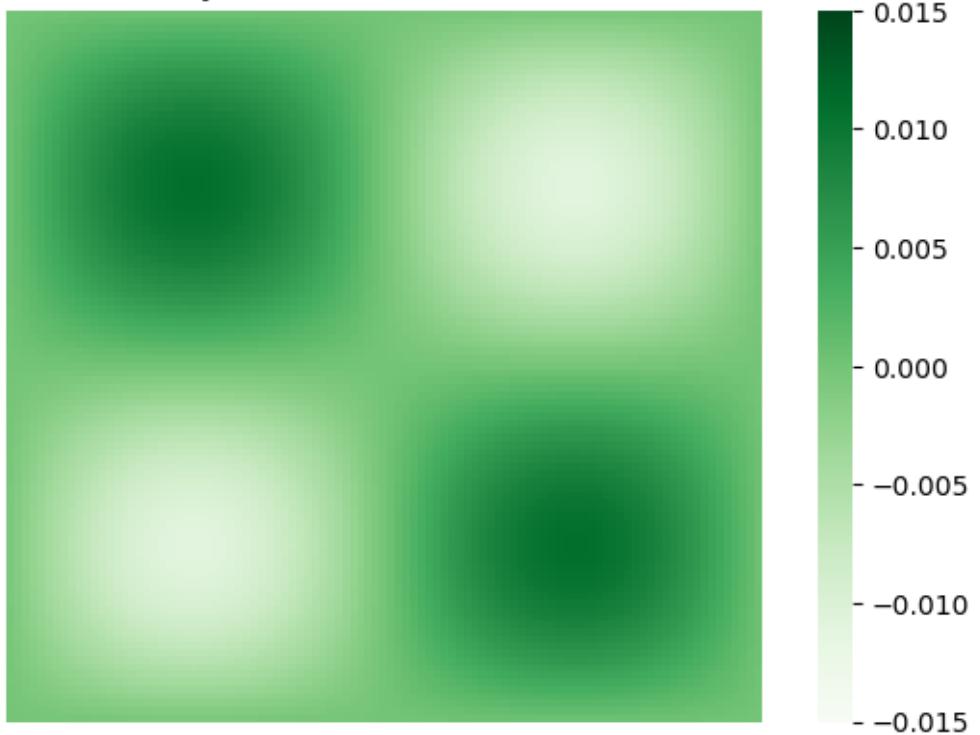
Q_4_Analytical_Solution_at_time_0.175000_.csv

Analytical Solution: Time = 0.17500000000000002



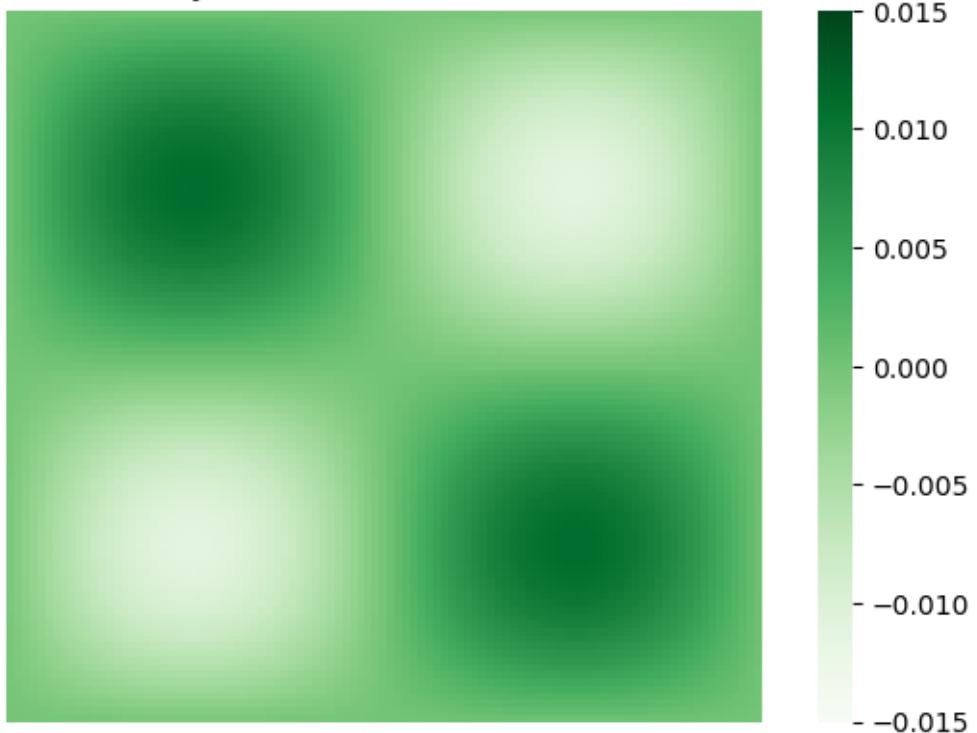
Q_4_Analytical_Solution_at_time_0.180000_.csv

Analytical Solution: Time = 0.18



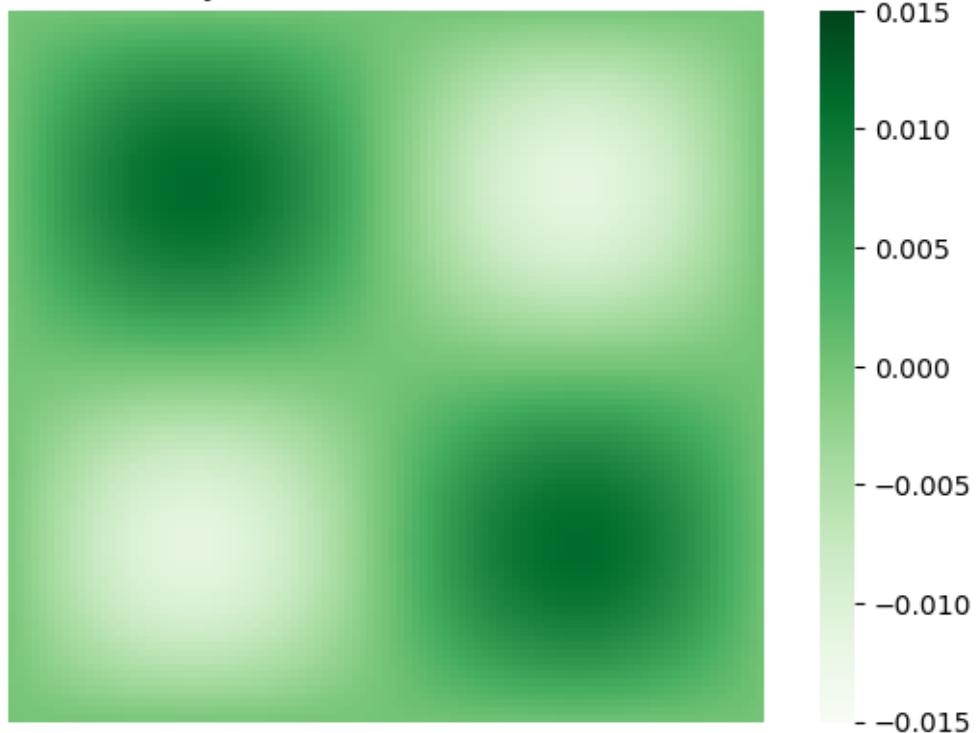
Q_4_Analytical_Solution_at_time_0.185000_.csv

Analytical Solution: Time = 0.185



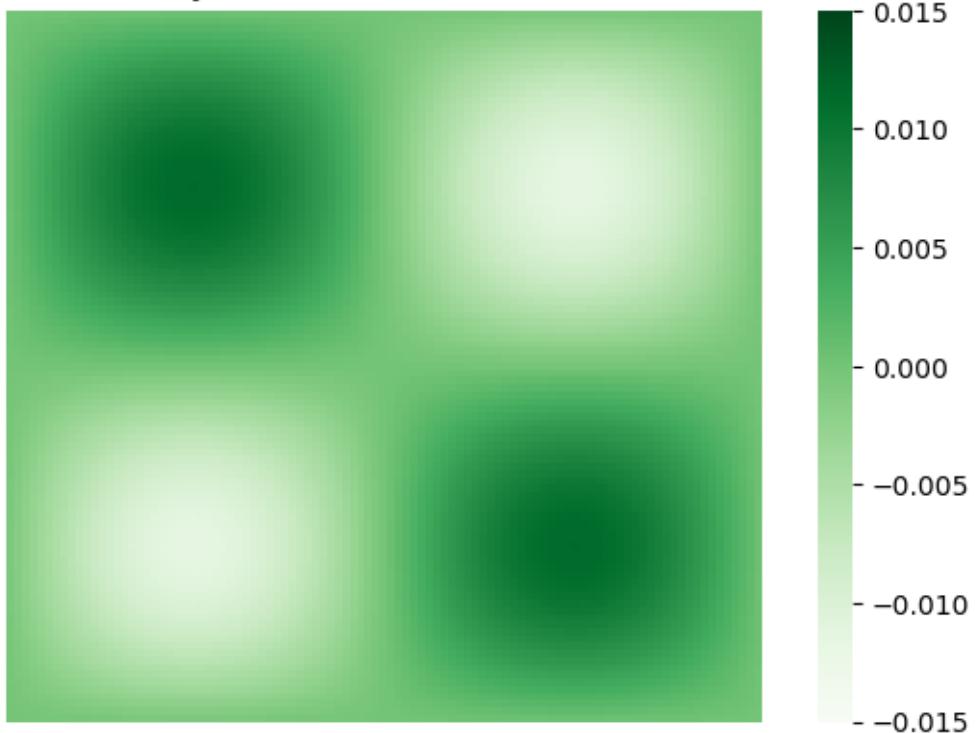
Q_4_Analytical_Solution_at_time_0.190000_.csv

Analytical Solution: Time = 0.19



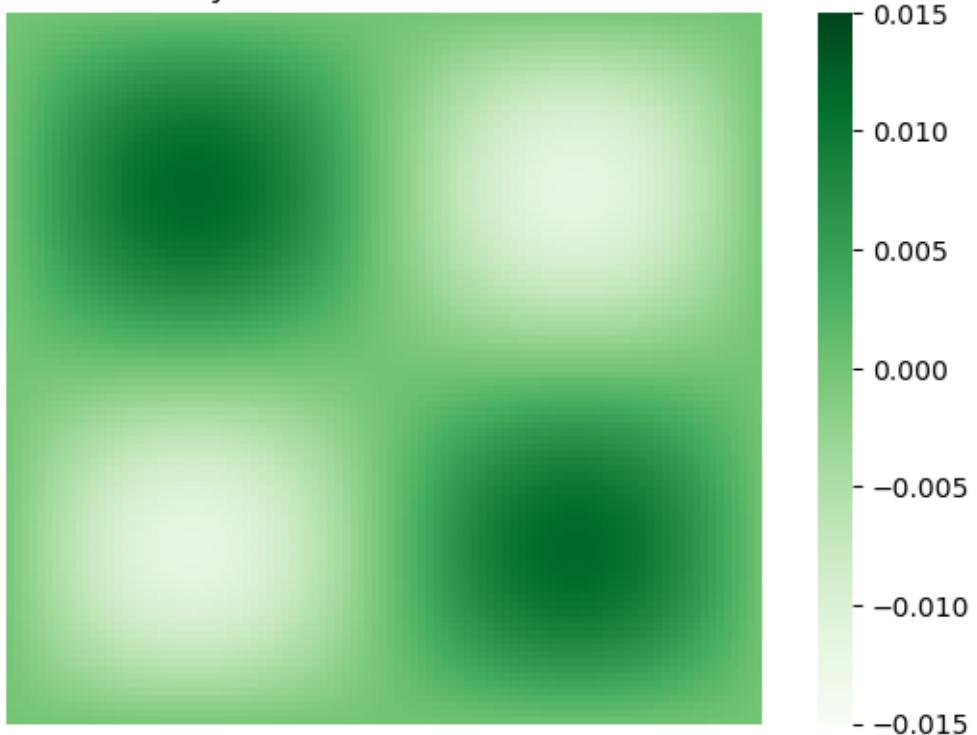
Q_4_Analytical_Solution_at_time_0.195000_.csv

Analytical Solution: Time = 0.195



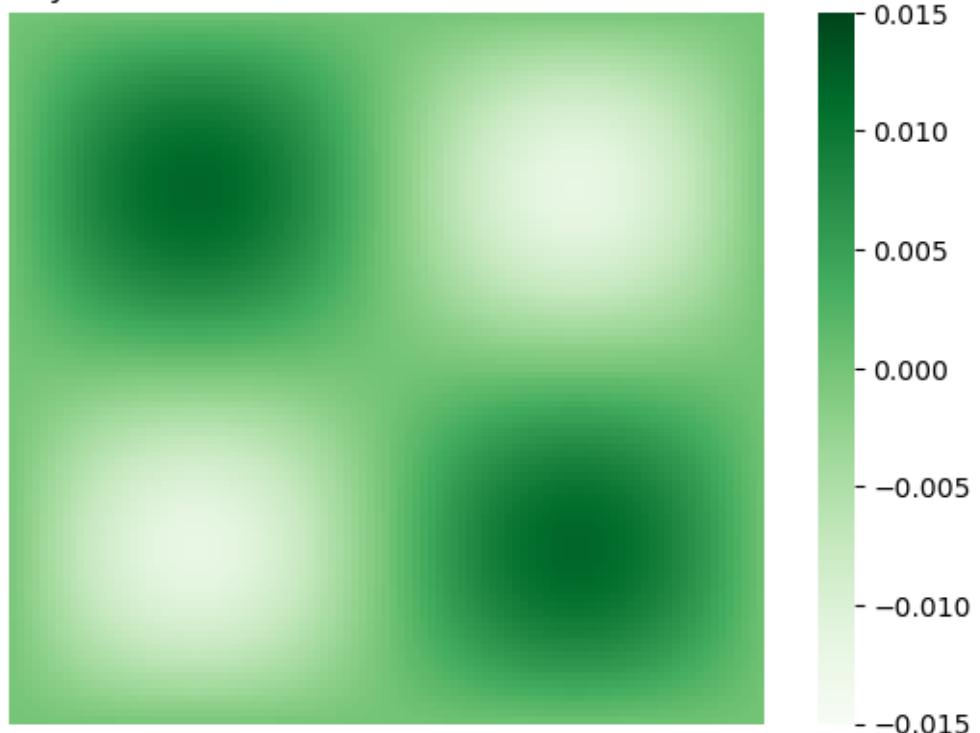
Q_4_Analytical_Solution_at_time_0.200000_.csv

Analytical Solution: Time = 0.2



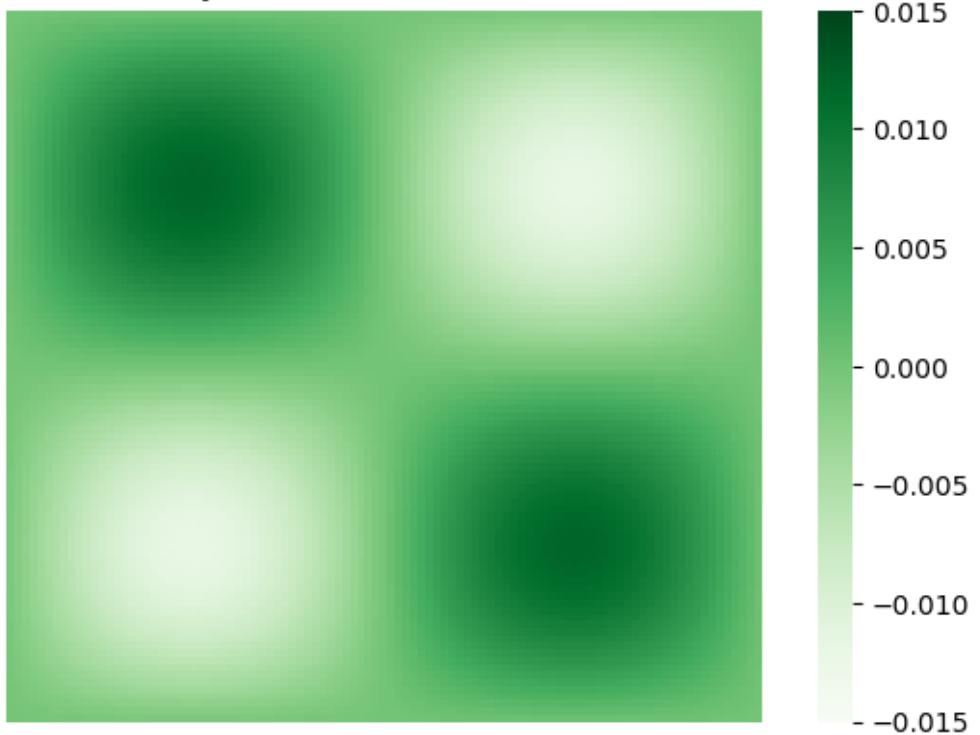
Q_4_Analytical_Solution_at_time_0.205000_.csv

Analytical Solution: Time = 0.20500000000000002



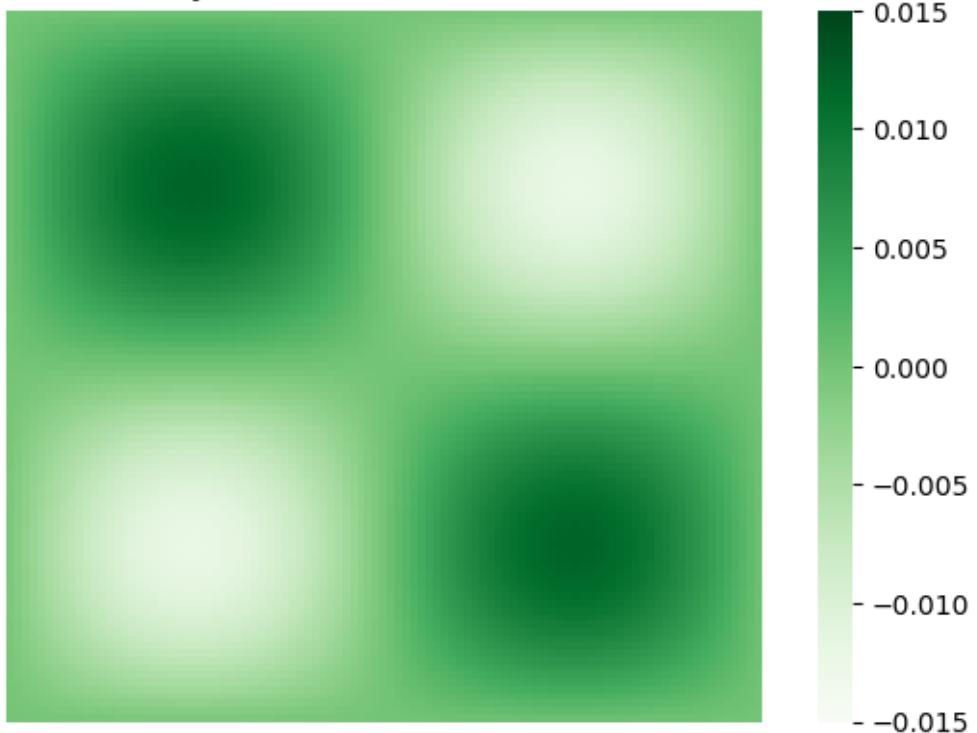
Q_4_Analytical_Solution_at_time_0.210000_.csv

Analytical Solution: Time = 0.21



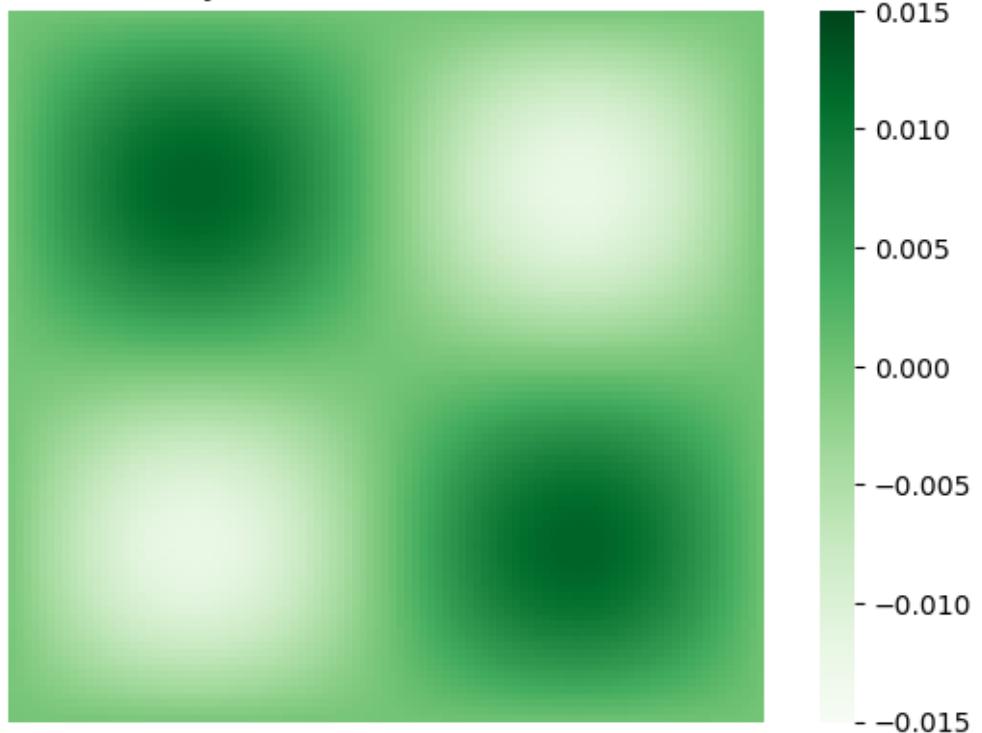
Q_4_Analytical_Solution_at_time_0.215000_.csv

Analytical Solution: Time = 0.215



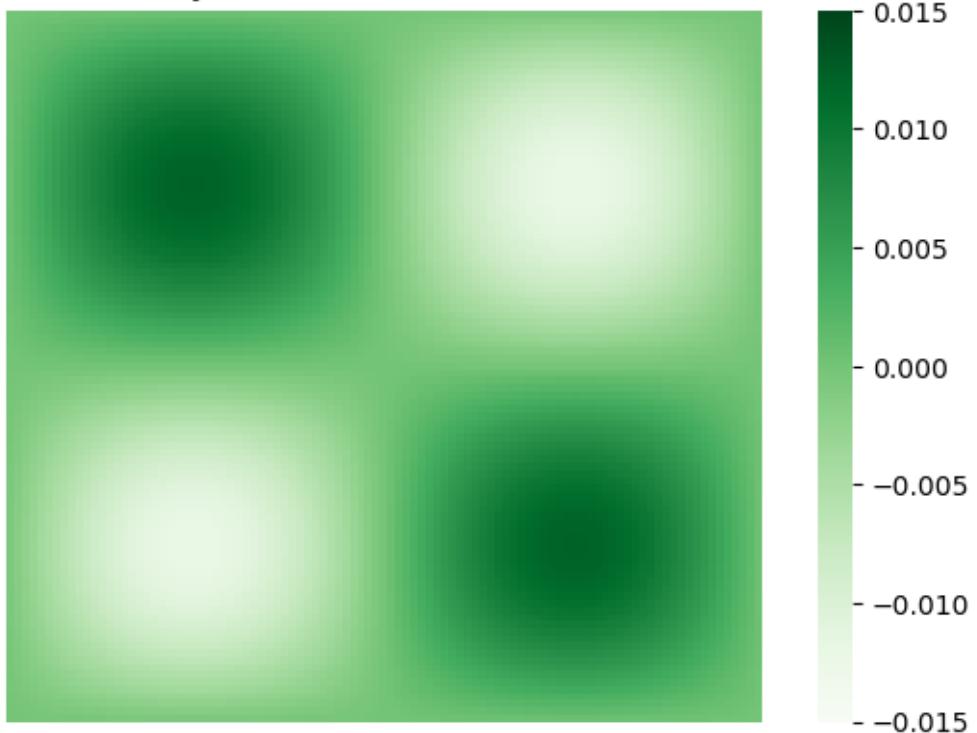
Q_4_Analytical_Solution_at_time_0.220000_.csv

Analytical Solution: Time = 0.22



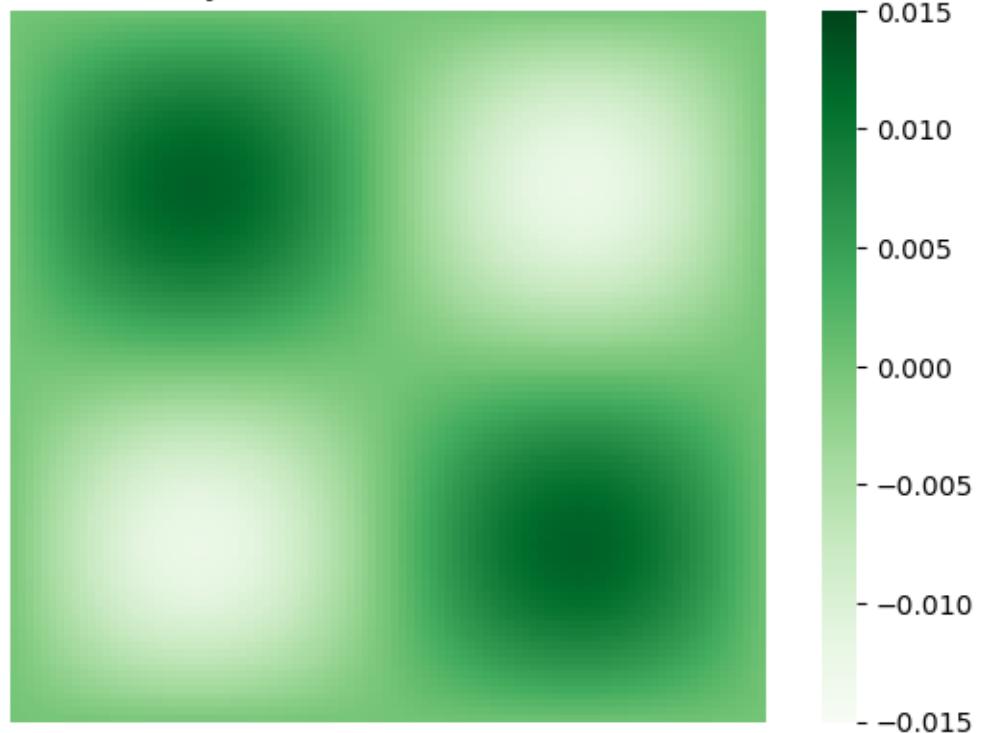
Q_4_Analytical_Solution_at_time_0.225000_.csv

Analytical Solution: Time = 0.225



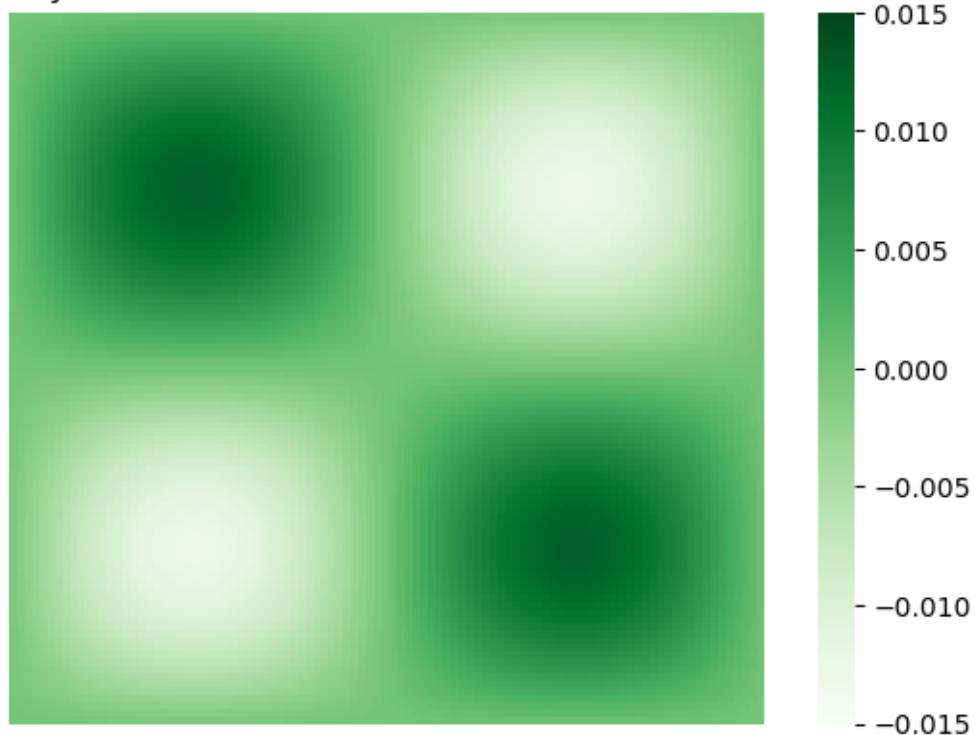
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Analytical Solution: Time = 0.23



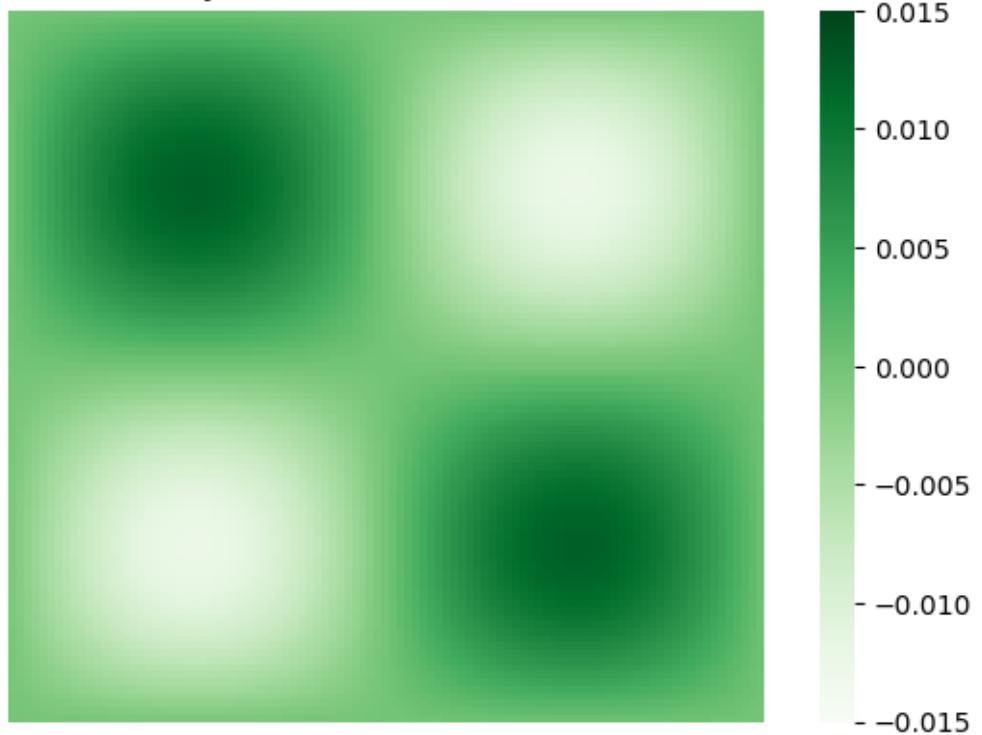
Q_4_Analytical_Solution_at_time_0.235000_.csv

Analytical Solution: Time = 0.23500000000000001



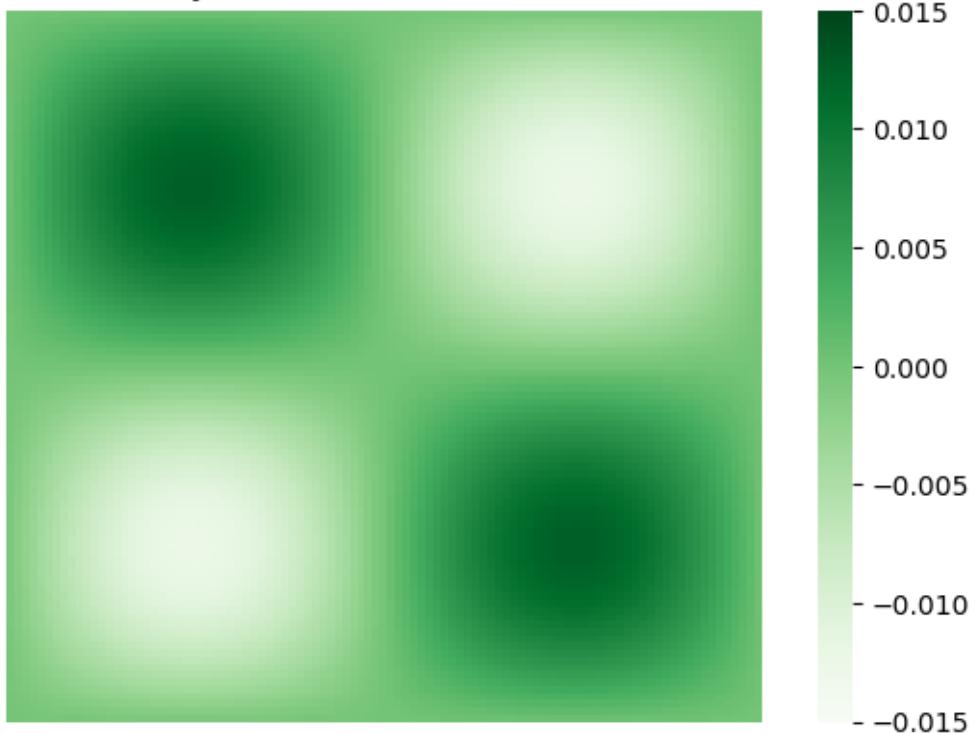
Q_4_Analytical_Solution_at_time_0.240000_.csv

Analytical Solution: Time = 0.24



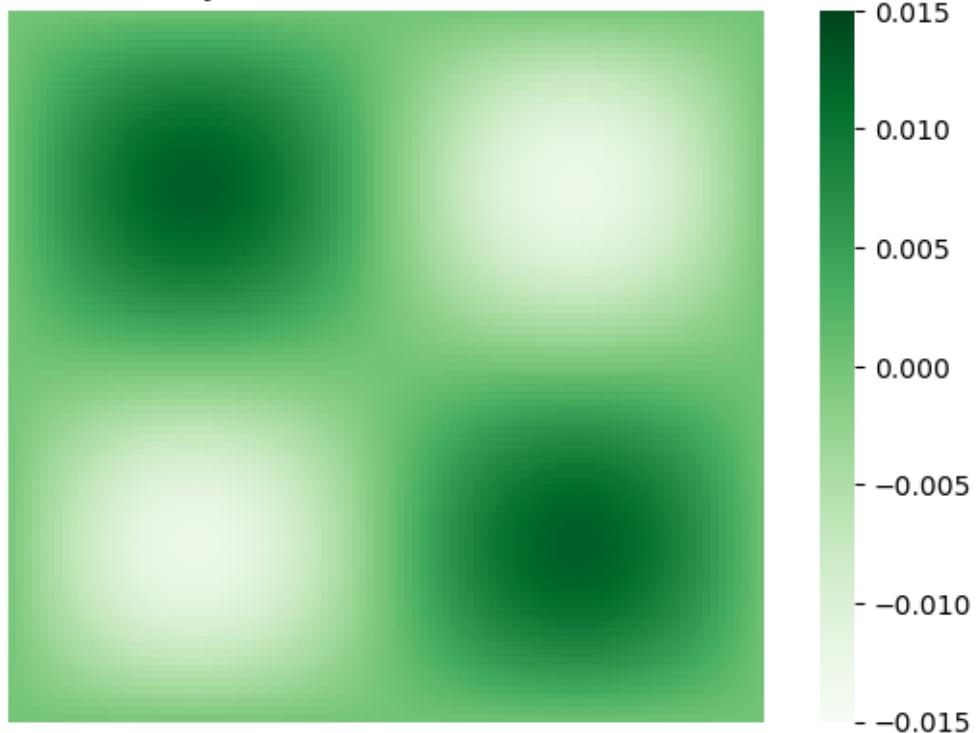
Q_4_Analytical_Solution_at_time_0.245000_.csv

Analytical Solution: Time = 0.245



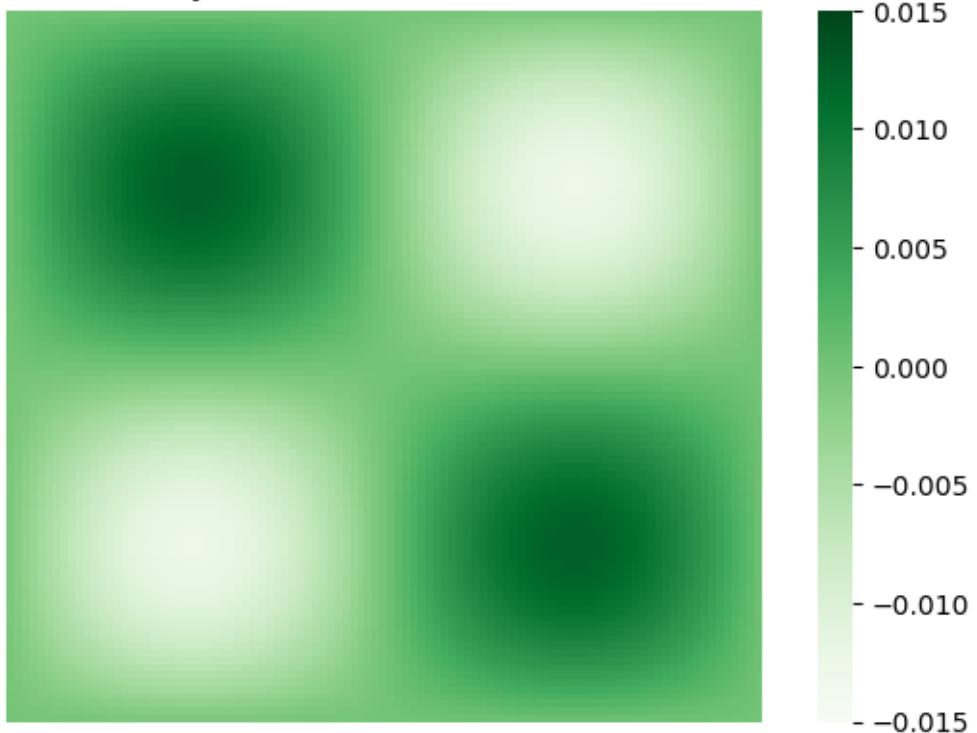
Q_4_Analytical_Solution_at_time_0.250000_.csv

Analytical Solution: Time = 0.25



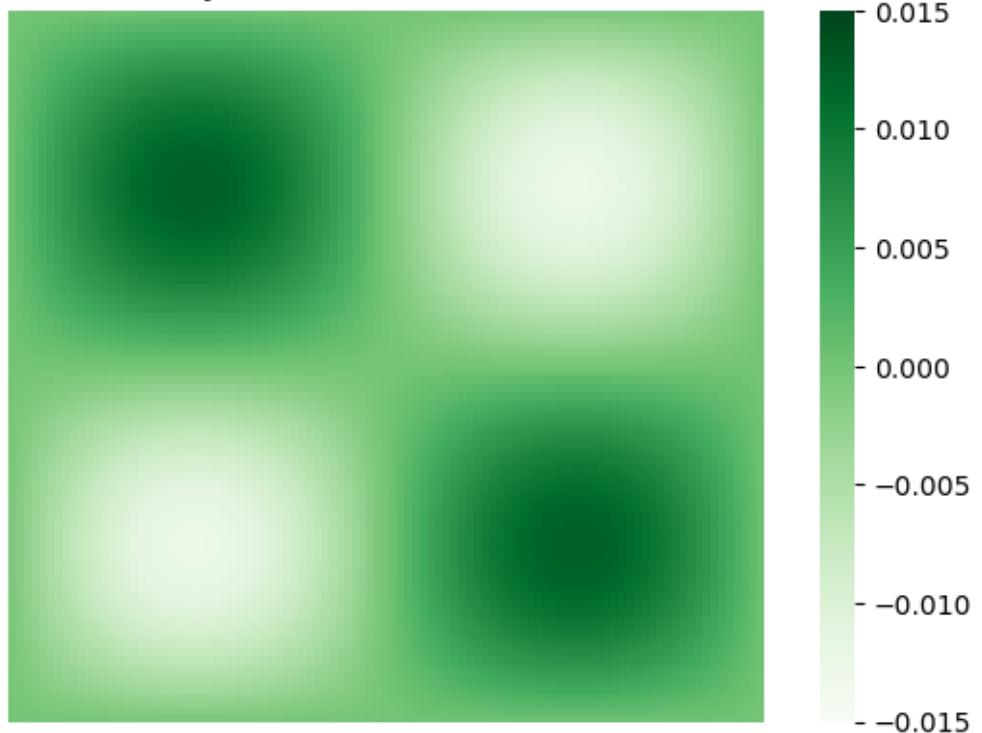
Q_4_Analytical_Solution_at_time_0.255000_.csv

Analytical Solution: Time = 0.255



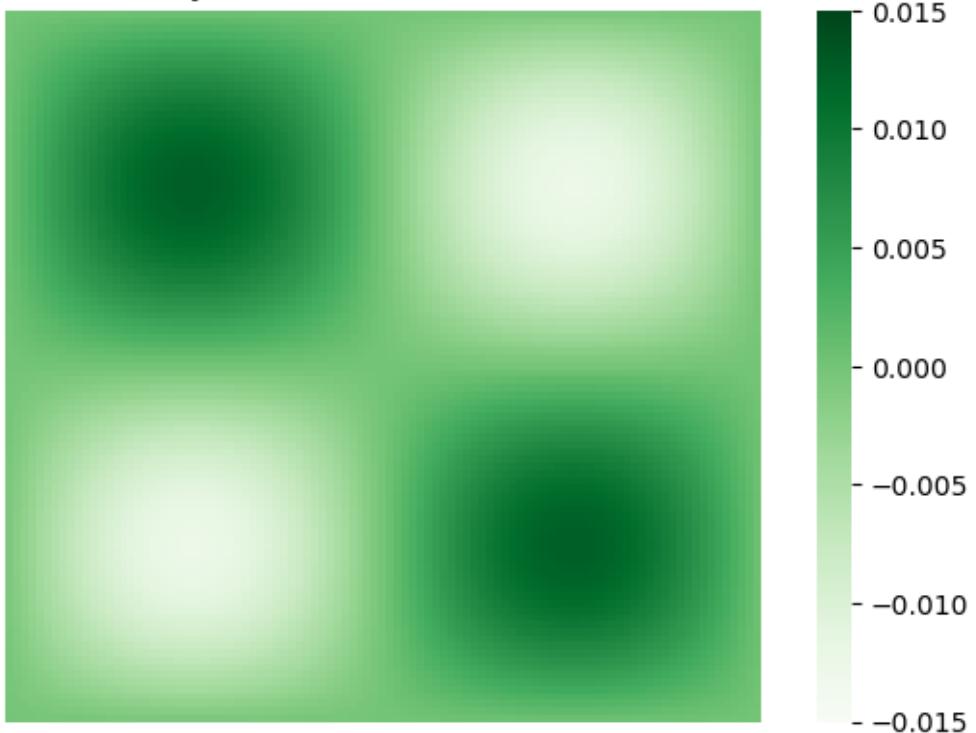
Q_4_Analytical_Solution_at_time_0.260000_.csv

Analytical Solution: Time = 0.26



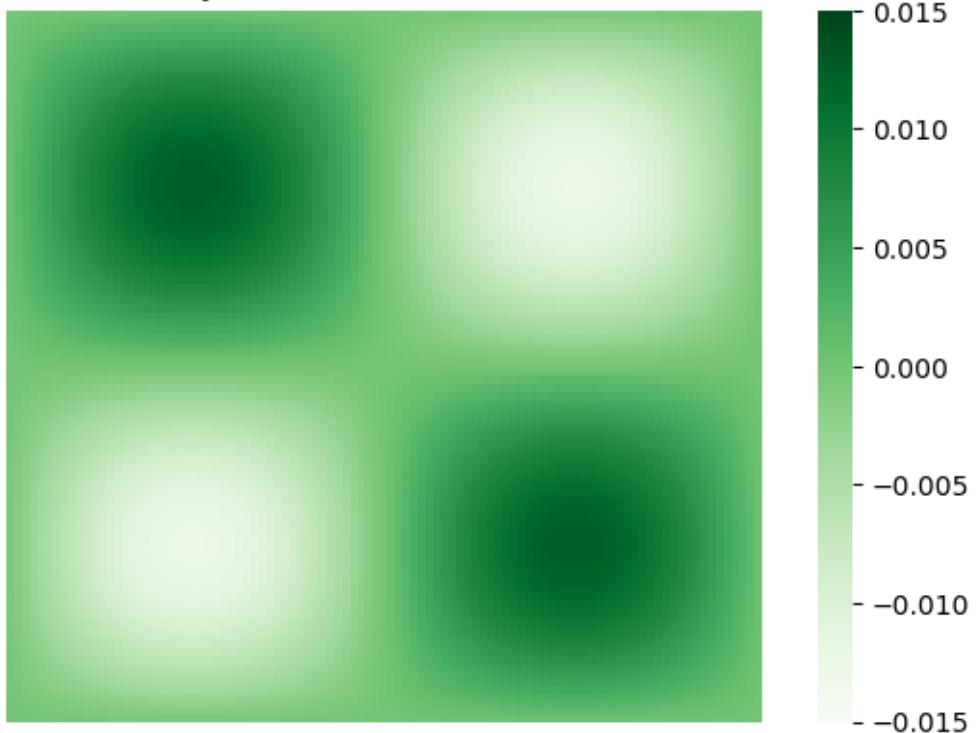
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Analytical Solution: Time = 0.265



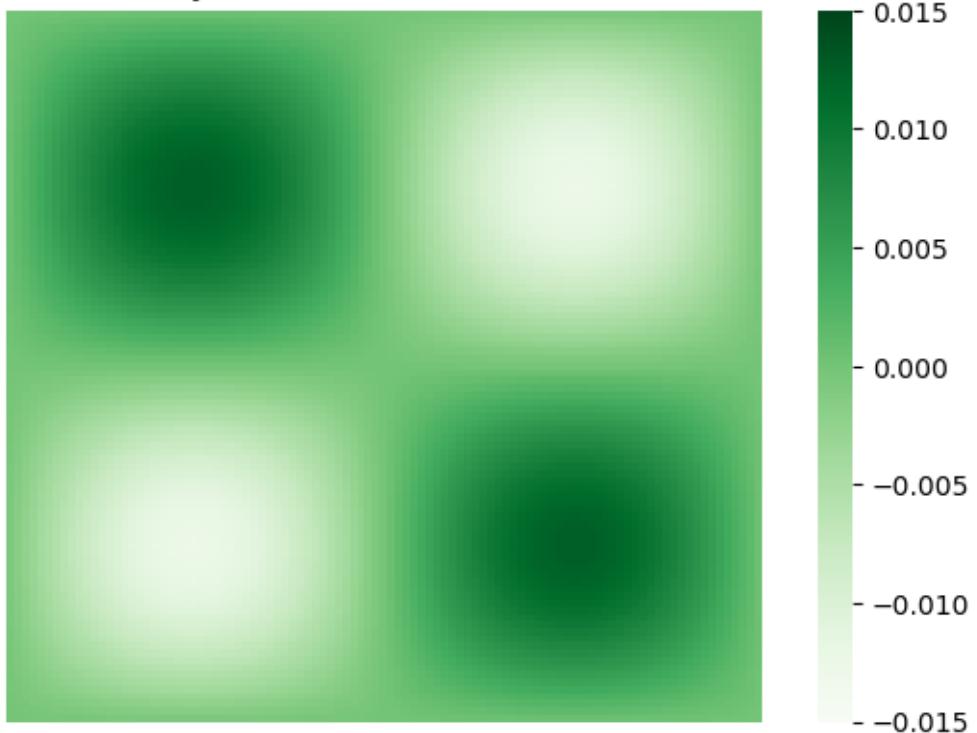
Q_4_Analytical_Solution_at_time_0.270000_.csv

Analytical Solution: Time = 0.27



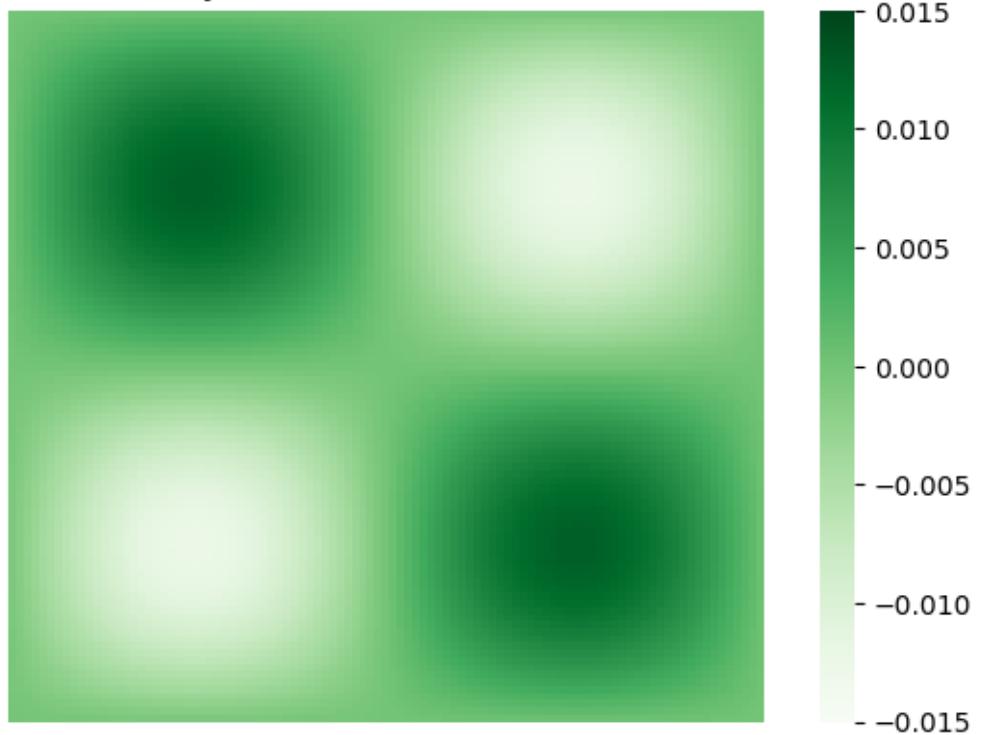
Q_4_Analytical_Solution_at_time_0.275000_.csv

Analytical Solution: Time = 0.275



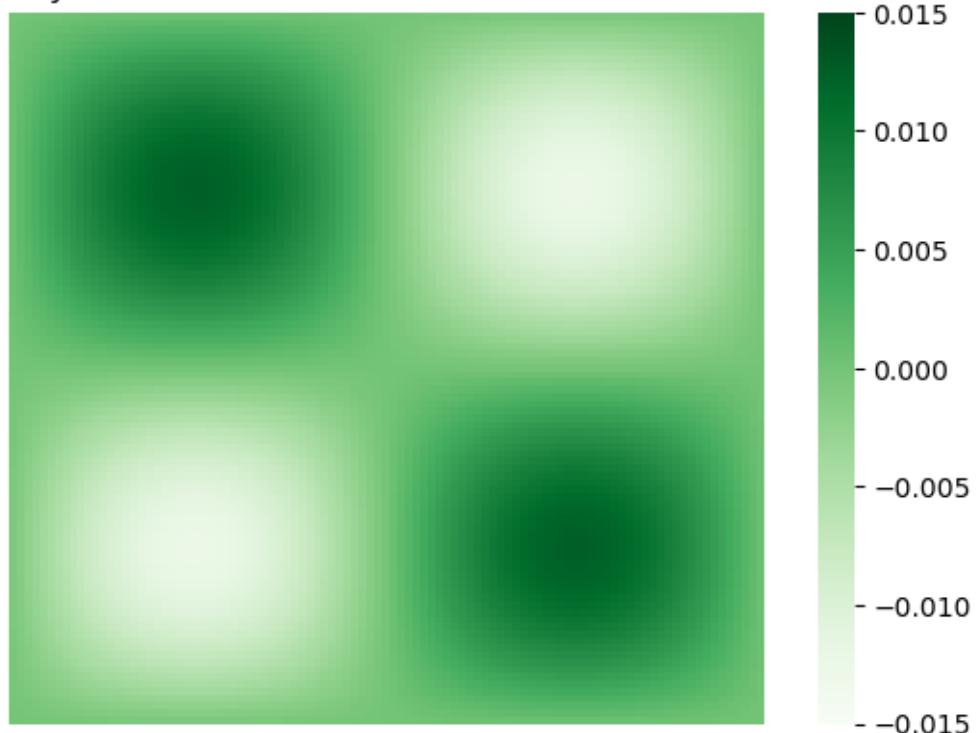
Q_4_Analytical_Solution_at_time_0.280000_.csv

Analytical Solution: Time = 0.28



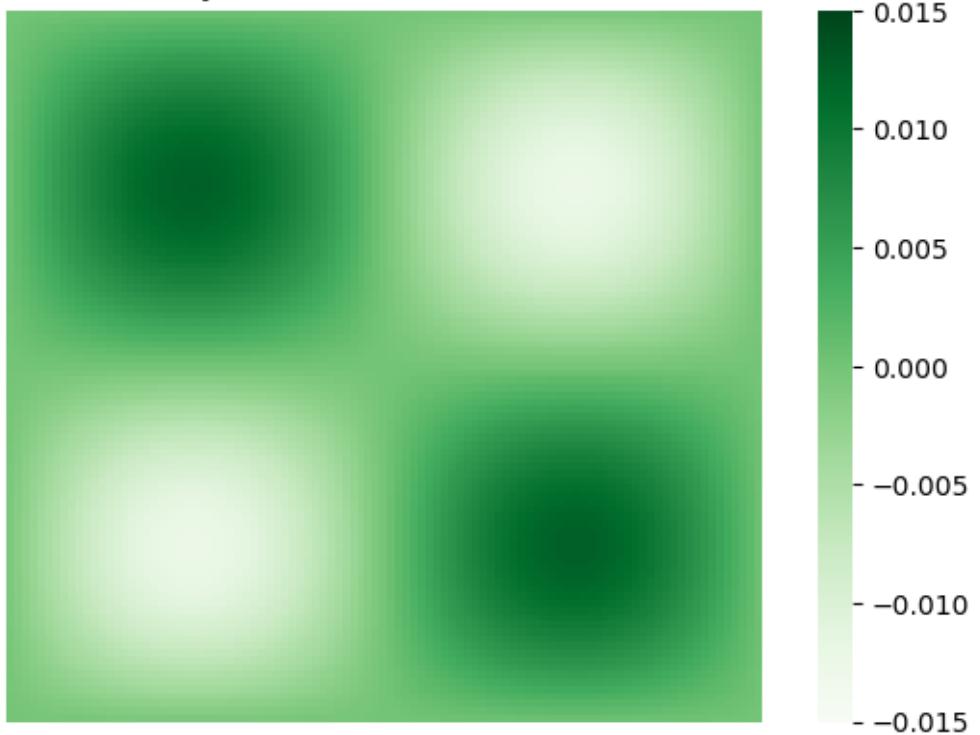
Q_4_Analytical_Solution_at_time_0.285000_.csv

Analytical Solution: Time = 0.28500000000000003



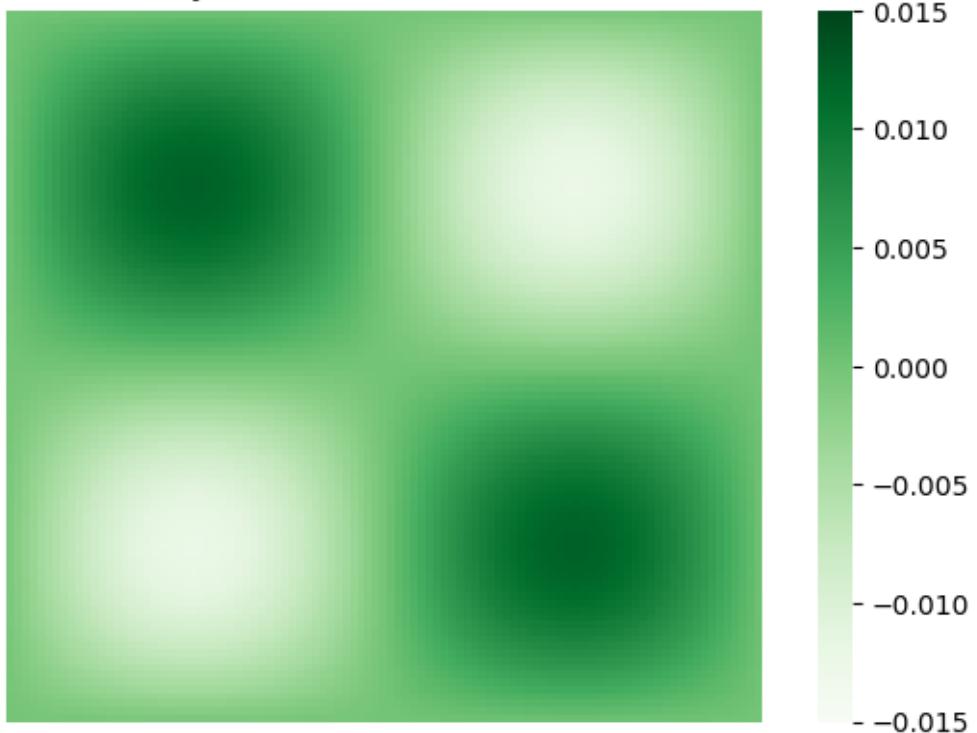
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Analytical Solution: Time = 0.29



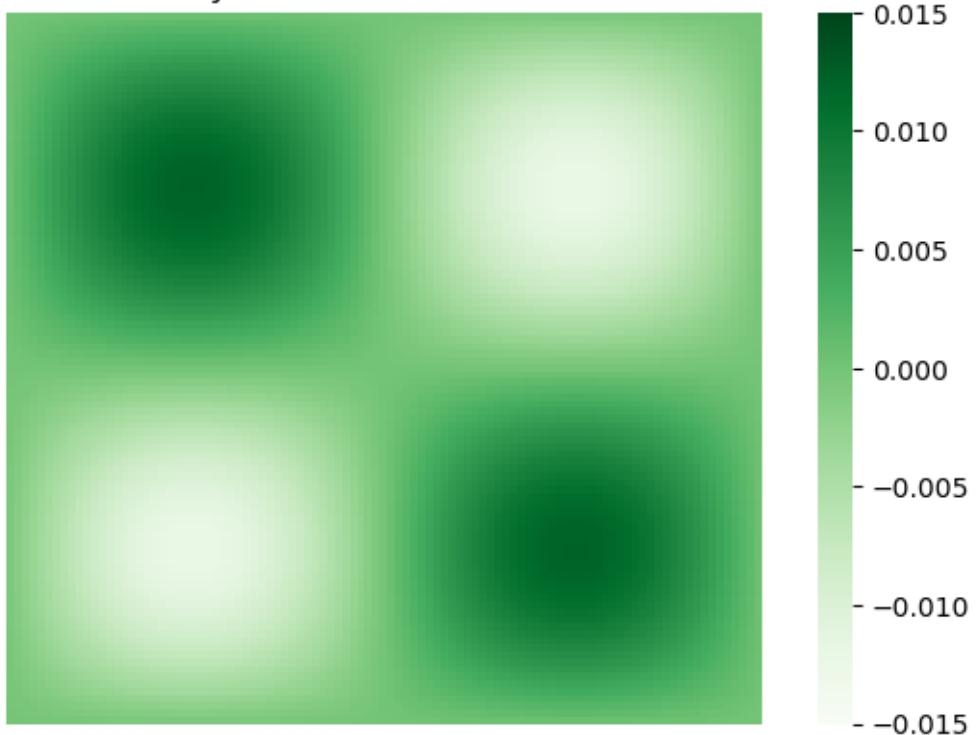
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Analytical Solution: Time = 0.295



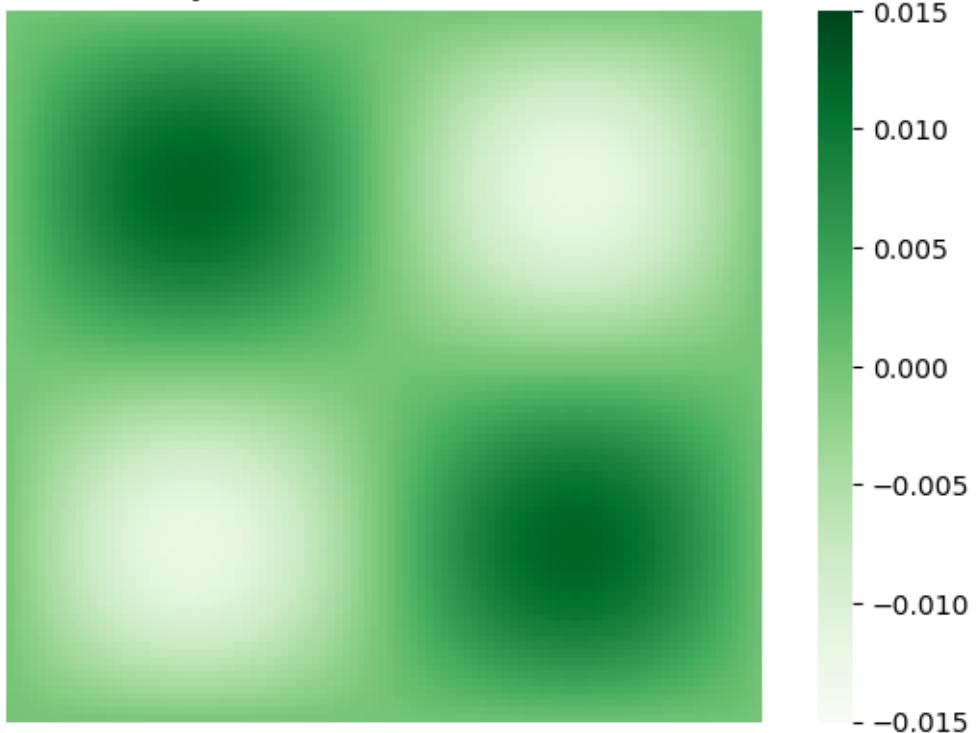
Q_4_Analytical_Solution_at_time_0.300000_.csv

Analytical Solution: Time = 0.3



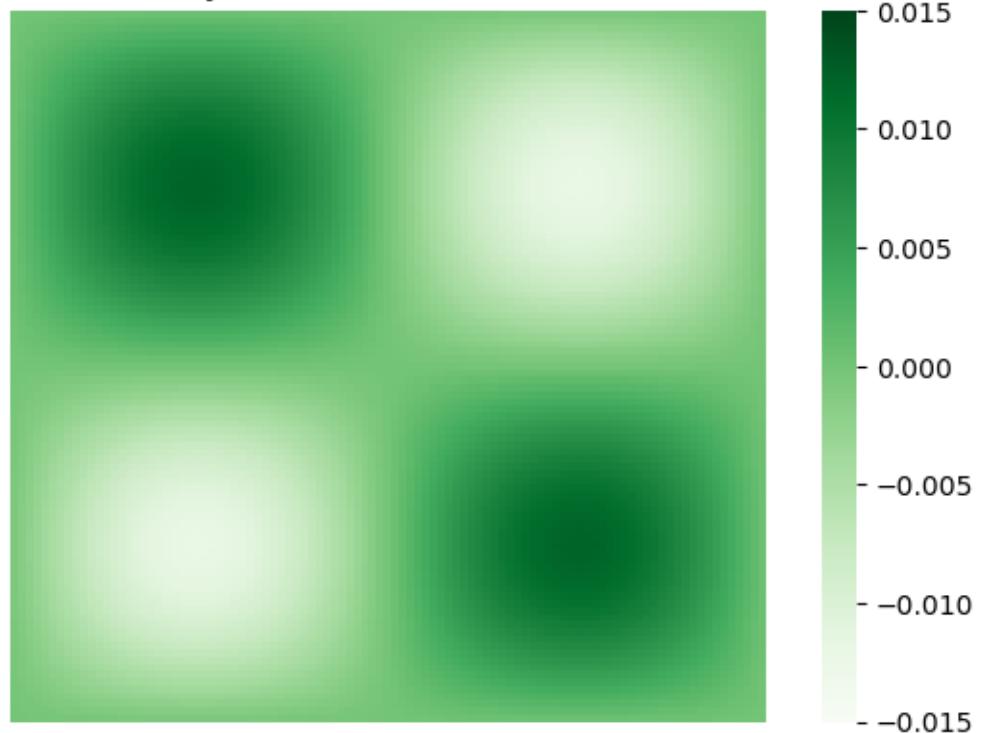
Q_4_Analytical_Solution_at_time_0.305000_.csv

Analytical Solution: Time = 0.305



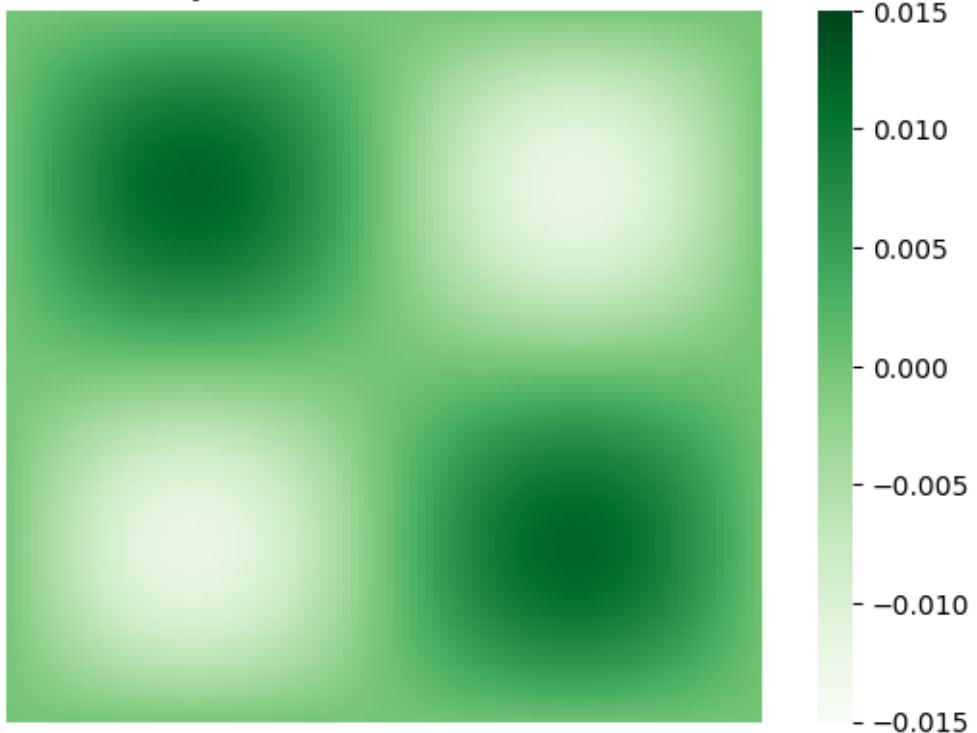
Q_4_Analytical_Solution_at_time_0.310000_.csv

Analytical Solution: Time = 0.31



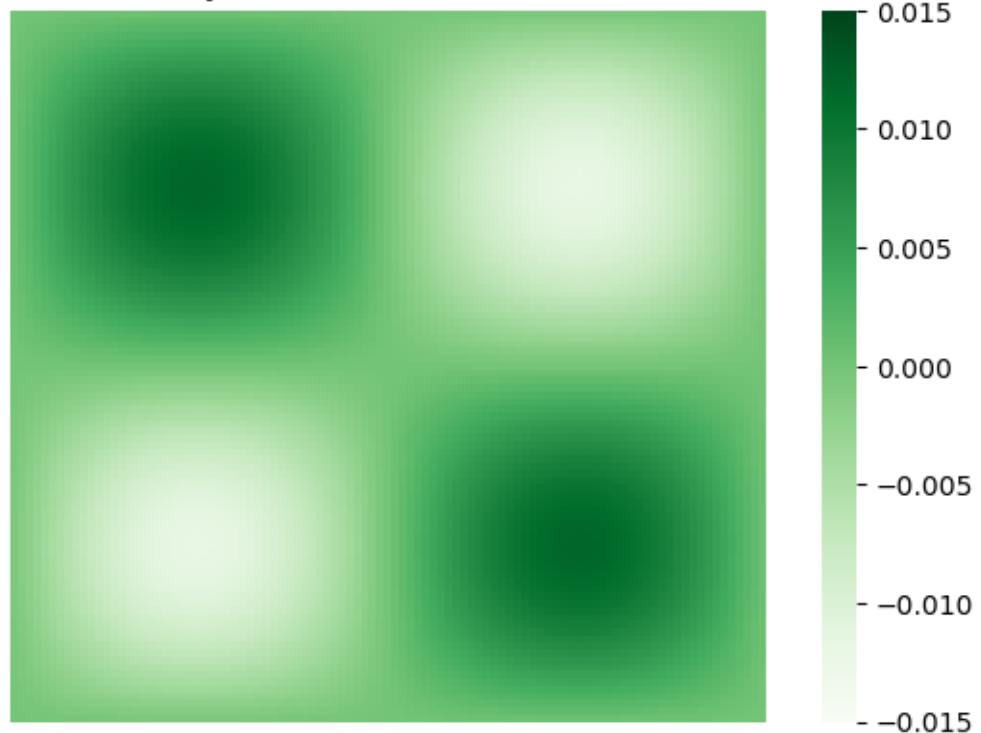
Q_4_Analytical_Solution_at_time_0.315000_.csv

Analytical Solution: Time = 0.315



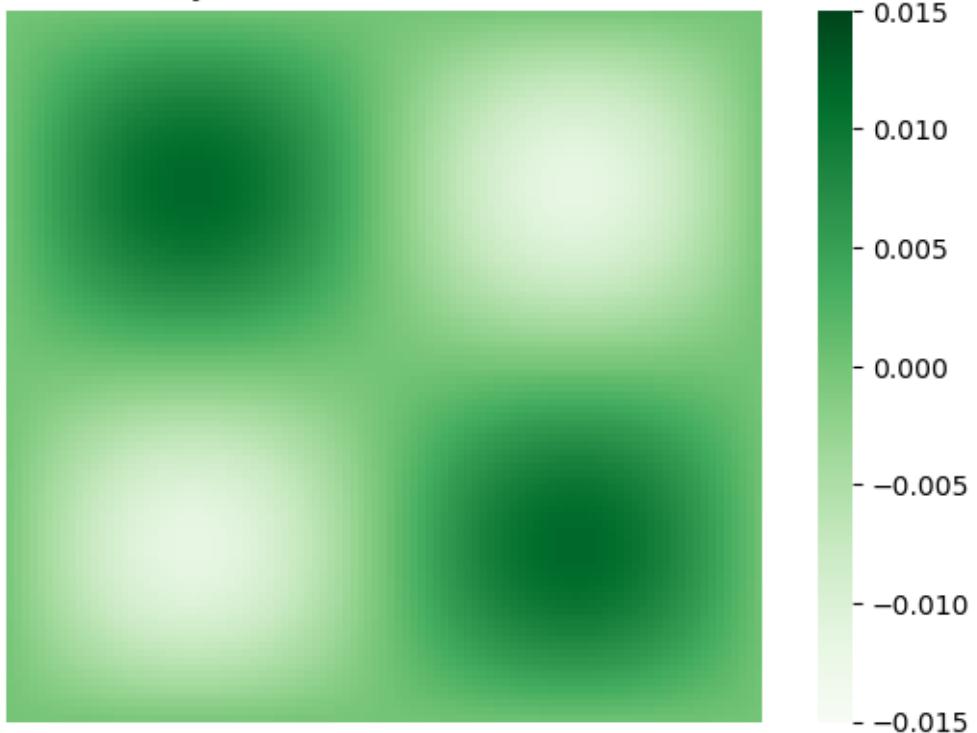
Q_4_Analytical_Solution_at_time_0.320000_.csv

Analytical Solution: Time = 0.32



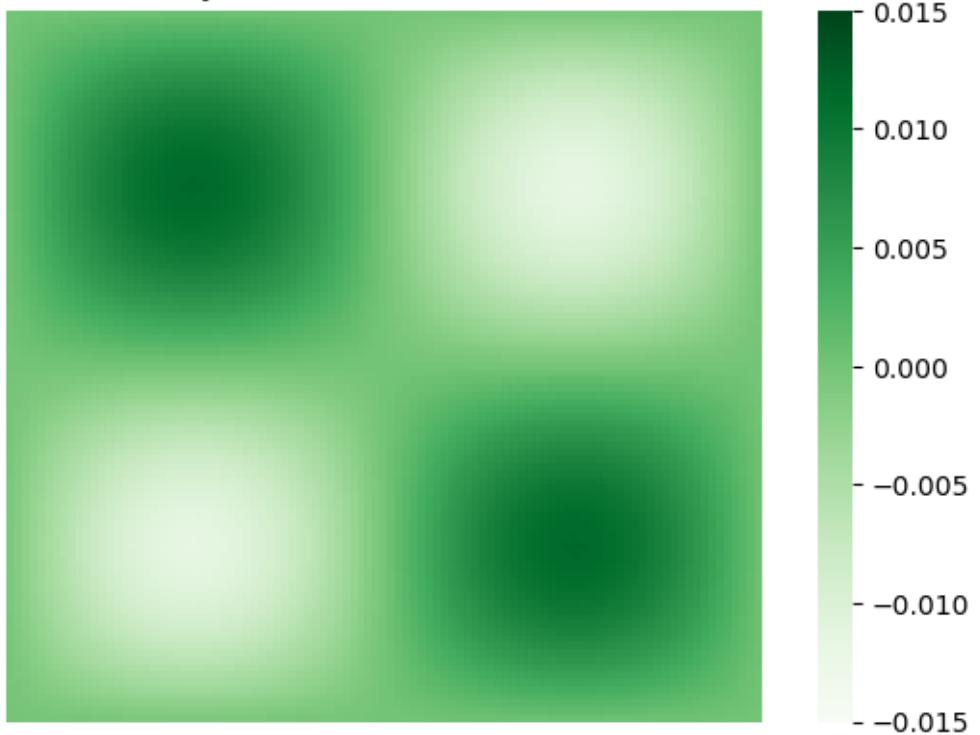
Q_4_Analytical_Solution_at_time_0.325000_.csv

Analytical Solution: Time = 0.325



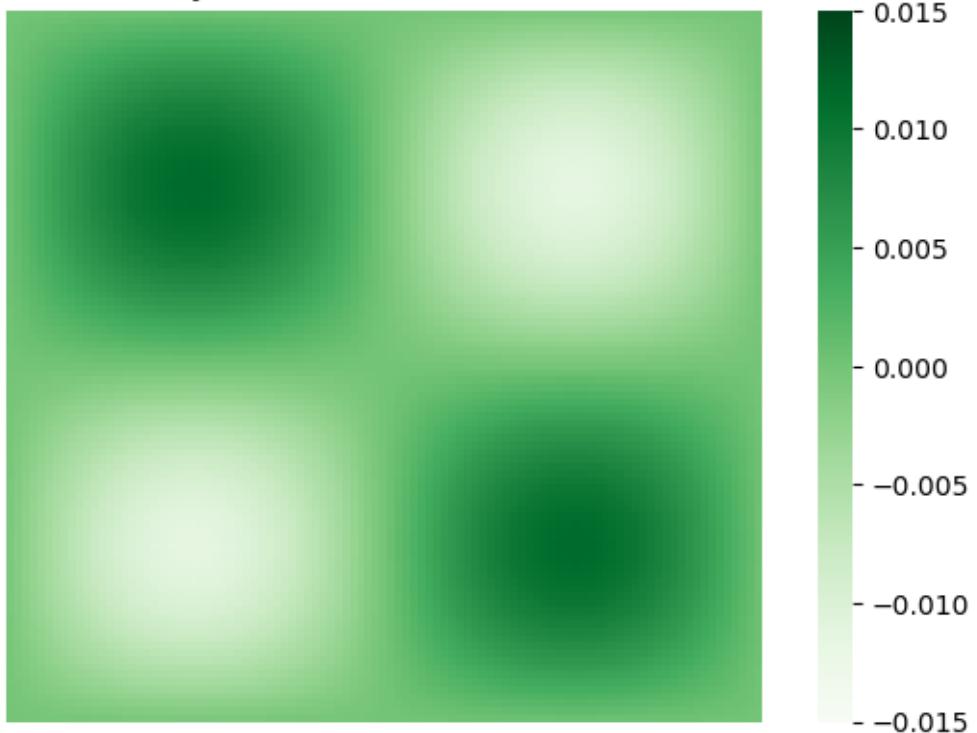
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Analytical Solution: Time = 0.33



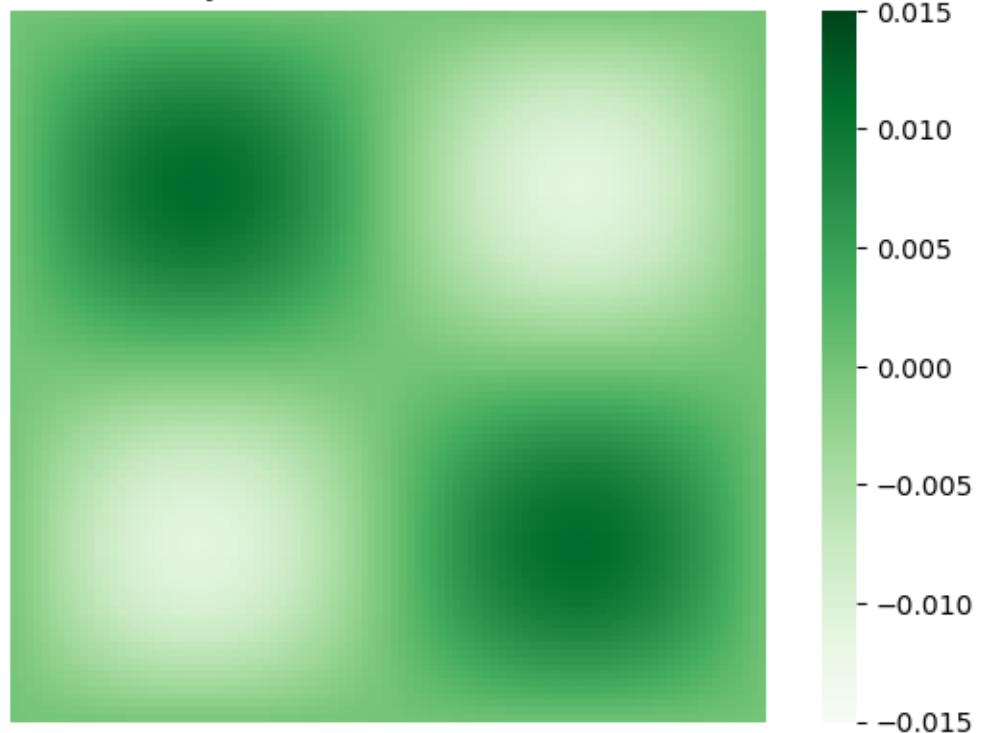
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Analytical Solution: Time = 0.335



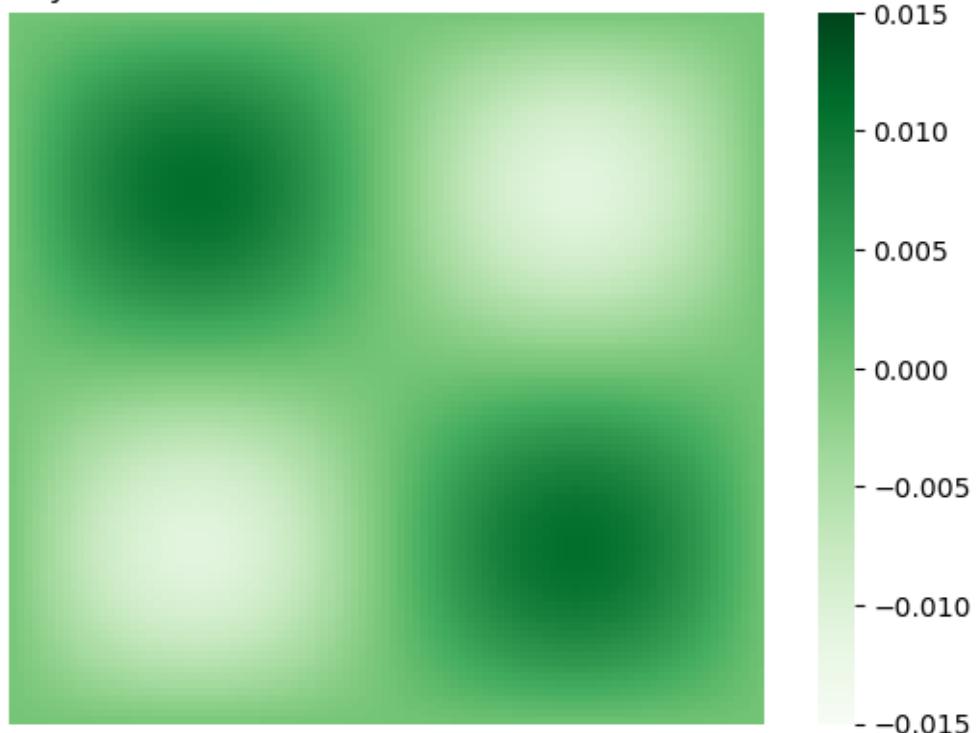
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Analytical Solution: Time = 0.34



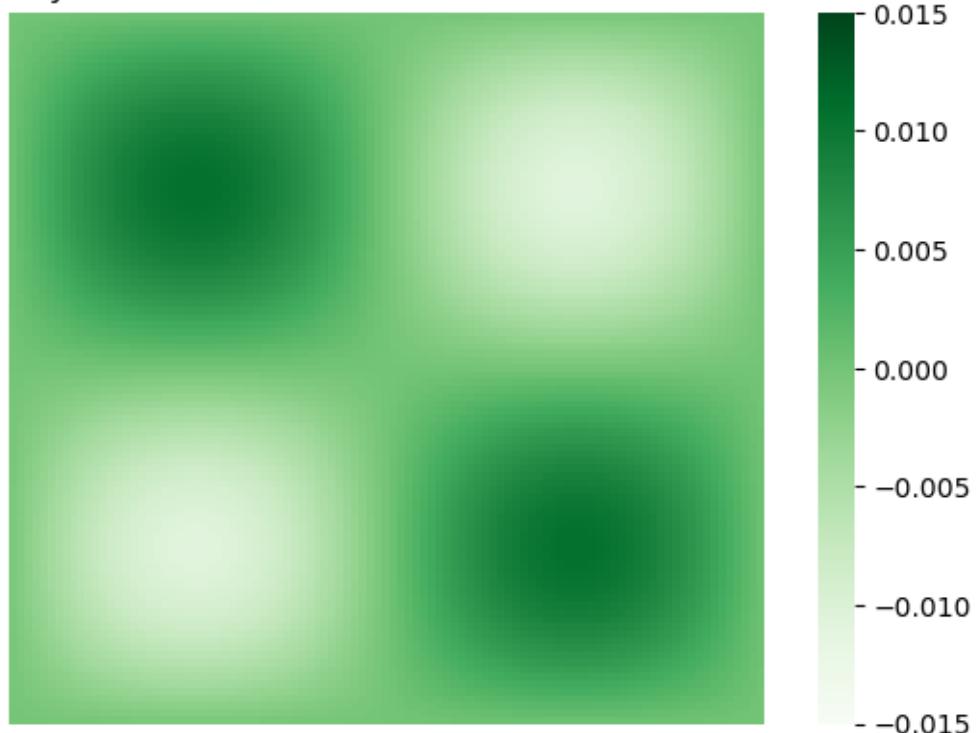
Q_4_Analytical_Solution_at_time_0.345000_.csv

Analytical Solution: Time = 0.34500000000000003



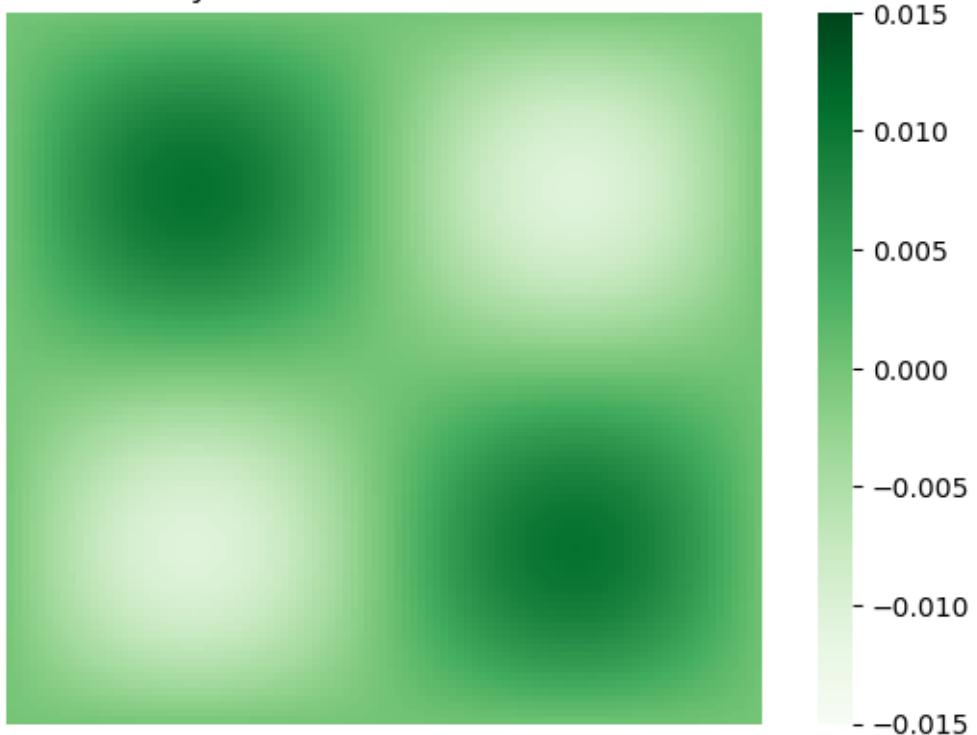
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Analytical Solution: Time = 0.35000000000000003



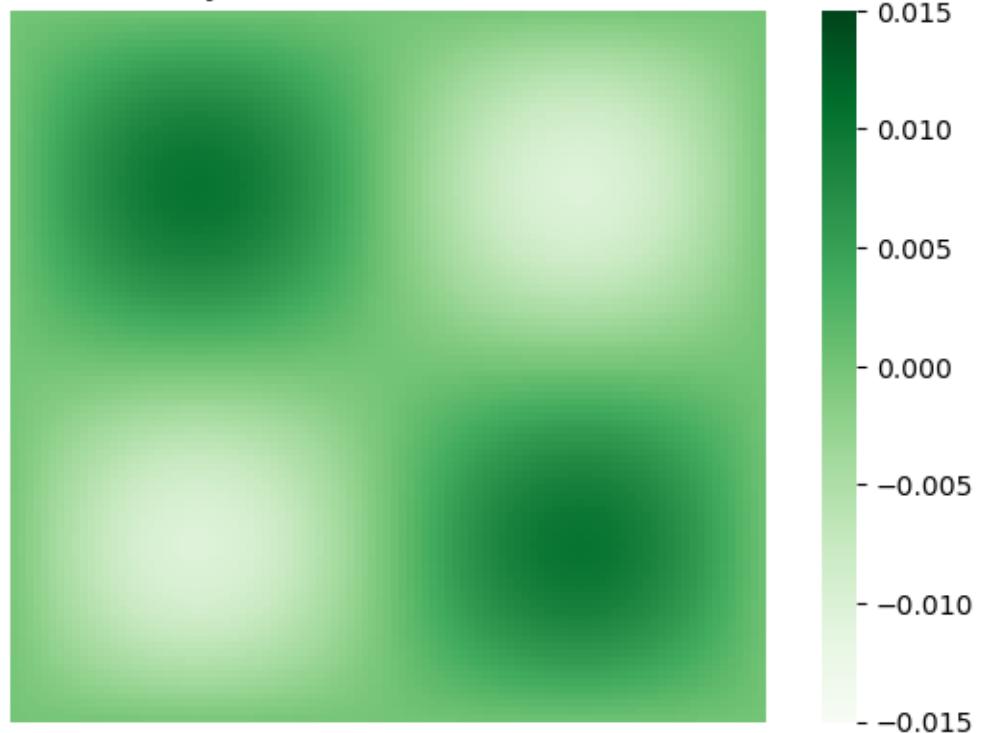
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Analytical Solution: Time = 0.355



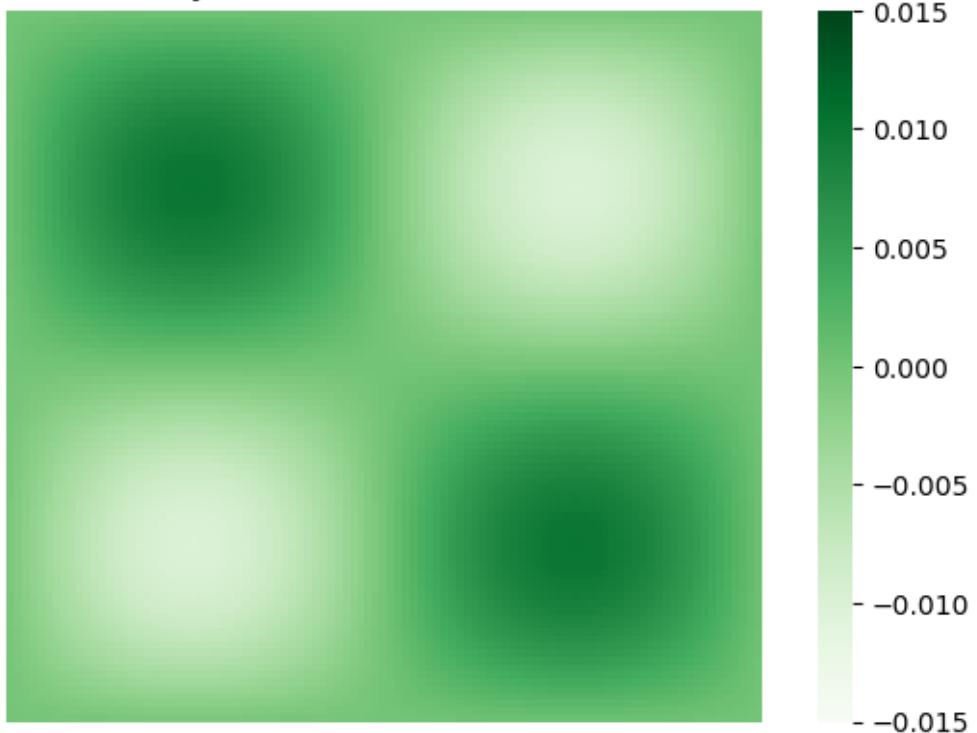
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Analytical Solution: Time = 0.36



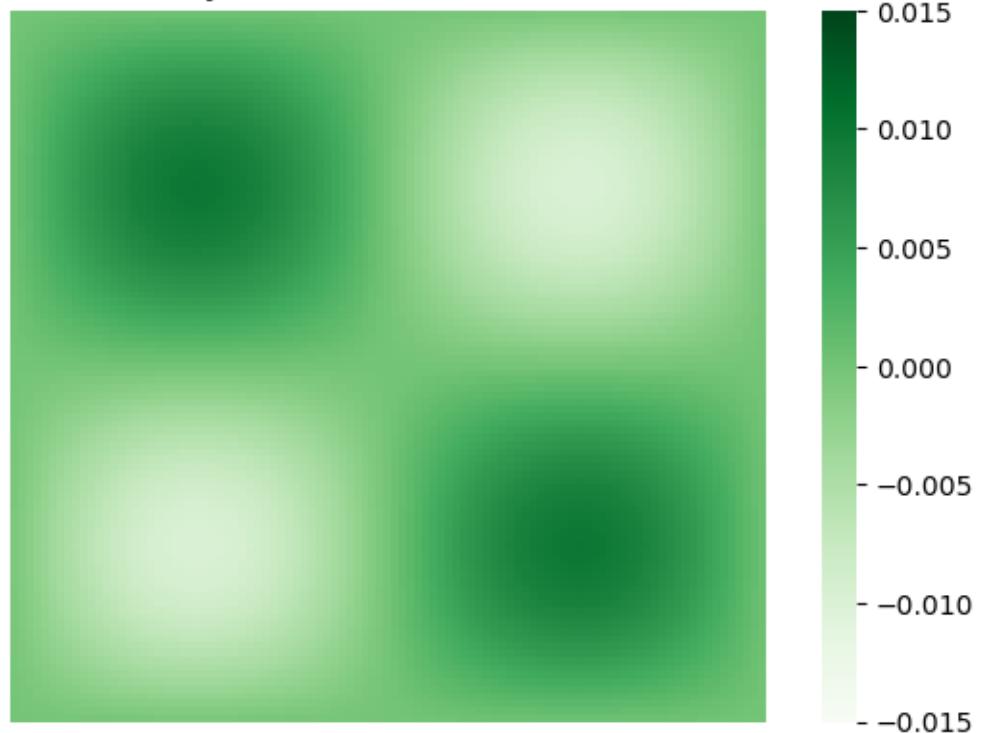
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Analytical Solution: Time = 0.365



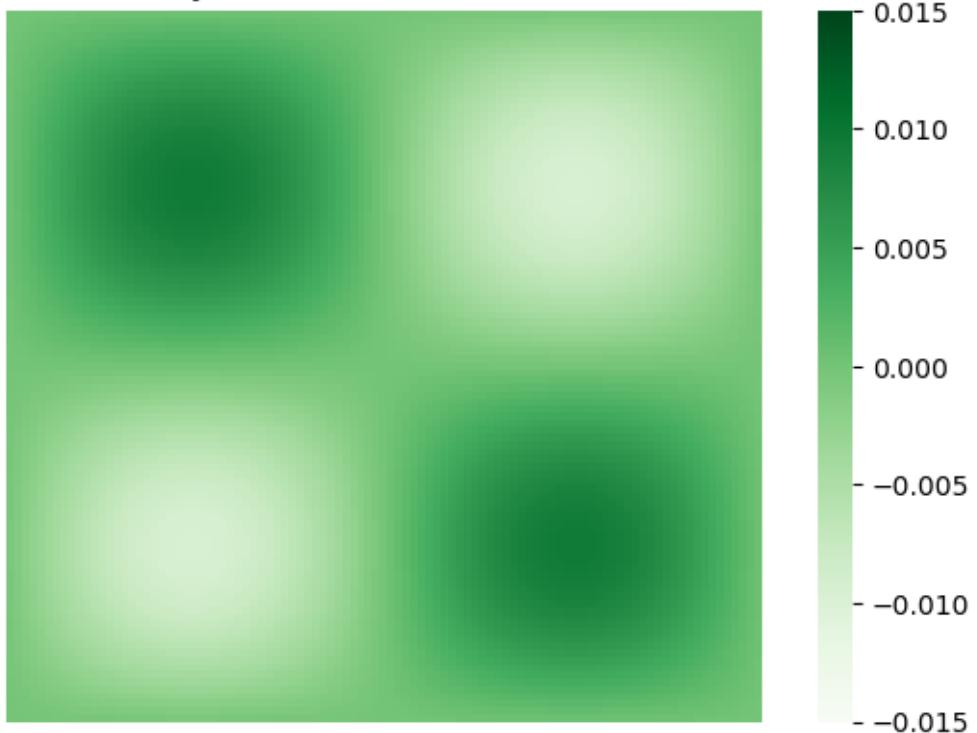
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Analytical Solution: Time = 0.37



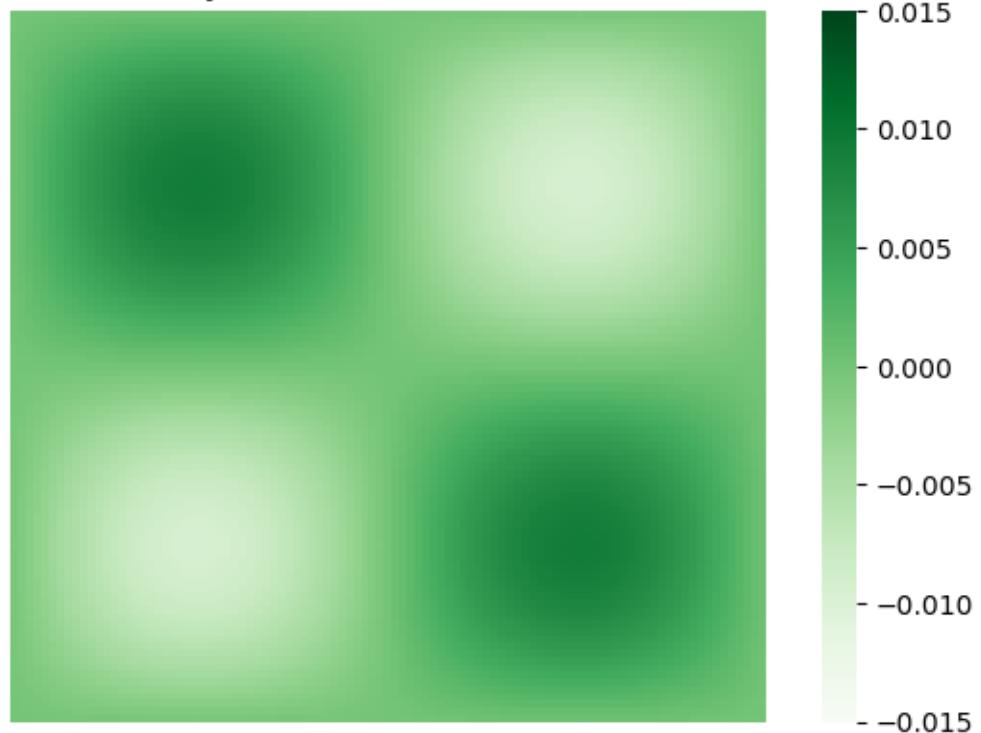
Q_4_Analytical_Solution_at_time_0.375000_.csv

Analytical Solution: Time = 0.375



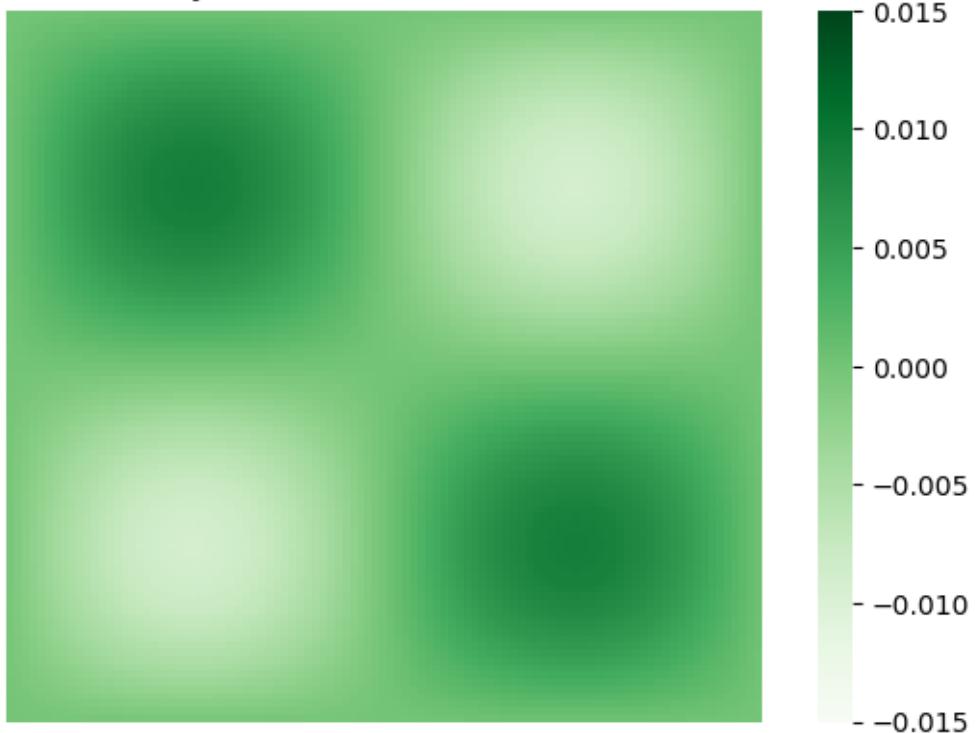
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Analytical Solution: Time = 0.38



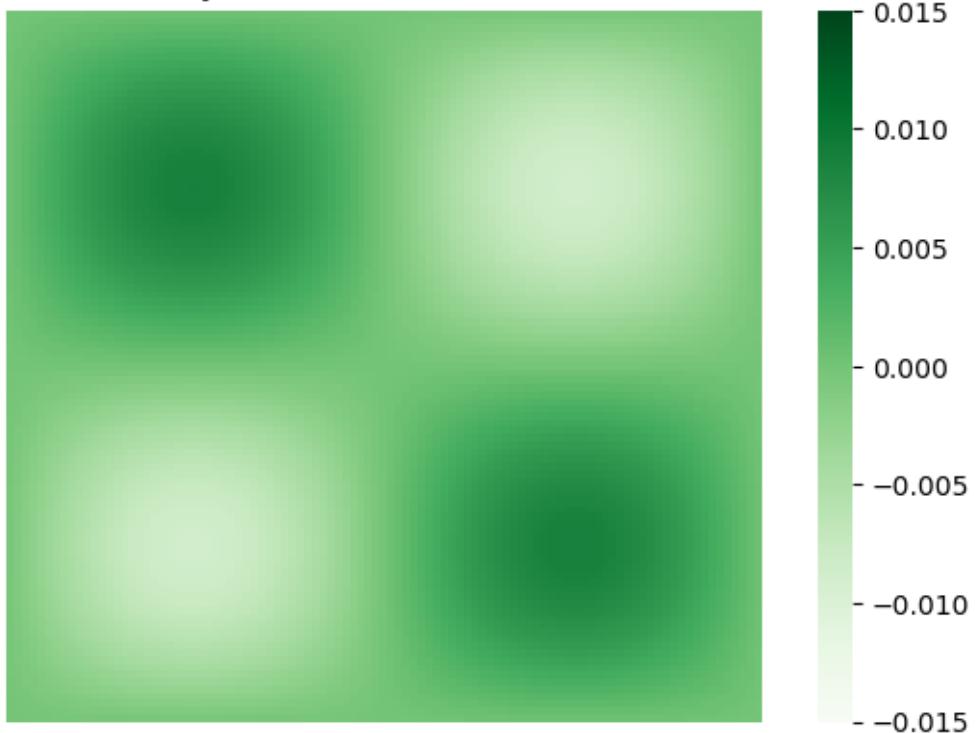
Q_4_Analytical_Solution_at_time_0.385000_.csv

Analytical Solution: Time = 0.385



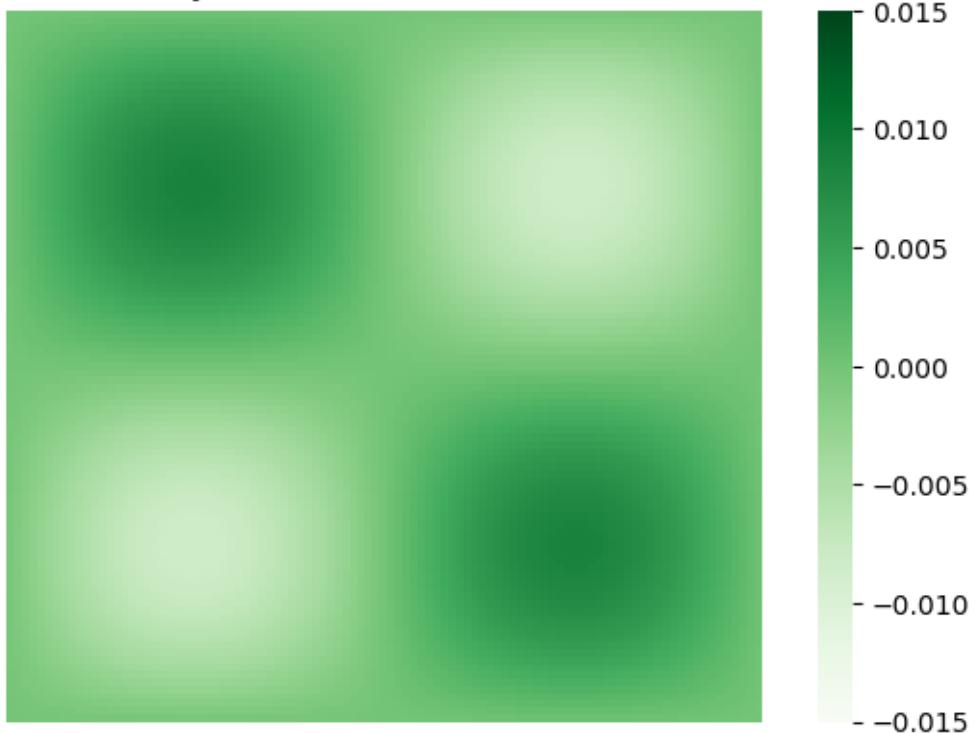
Q_4_Analytical_Solution_at_time_0.390000_.csv

Analytical Solution: Time = 0.39



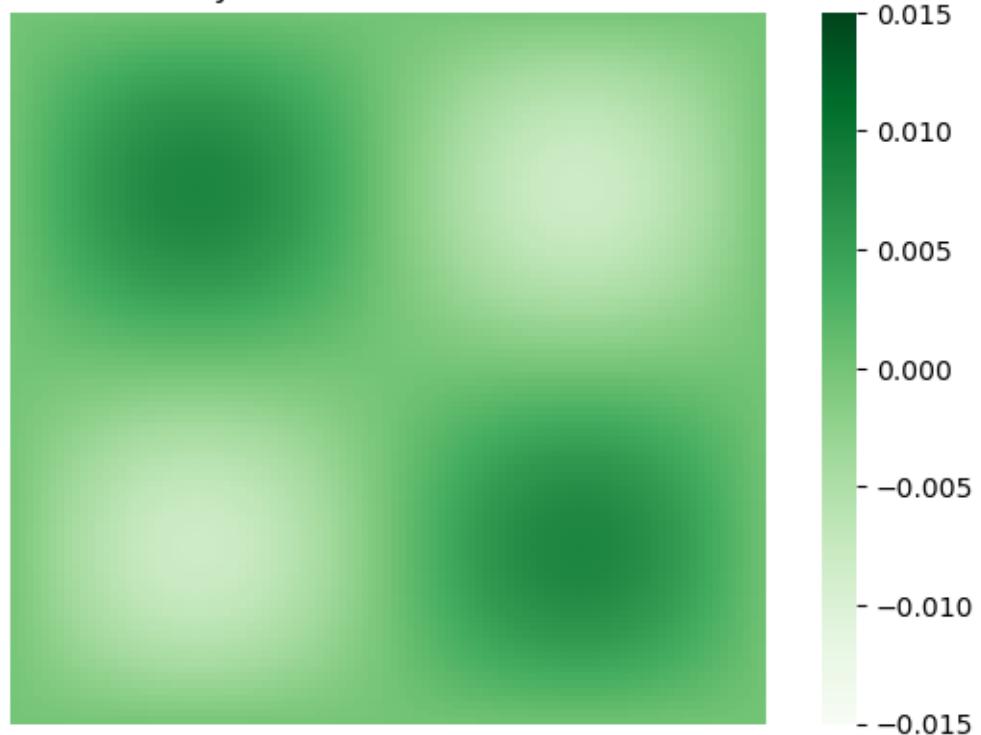
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Analytical Solution: Time = 0.395



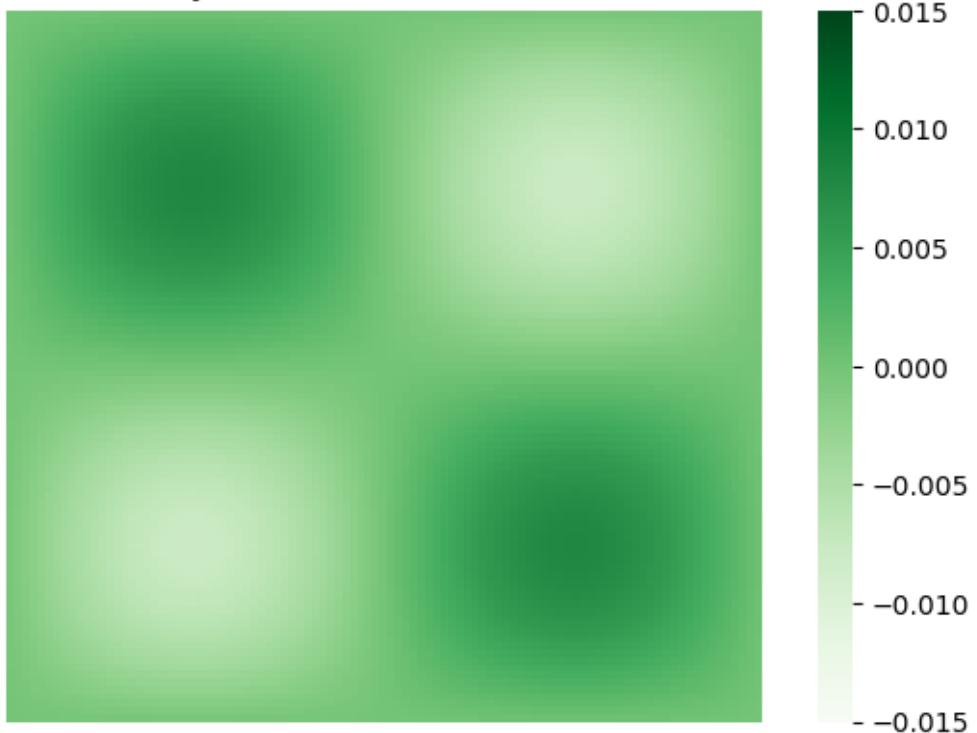
Q_4_Analytical_Solution_at_time_0.400000_.csv

Analytical Solution: Time = 0.4



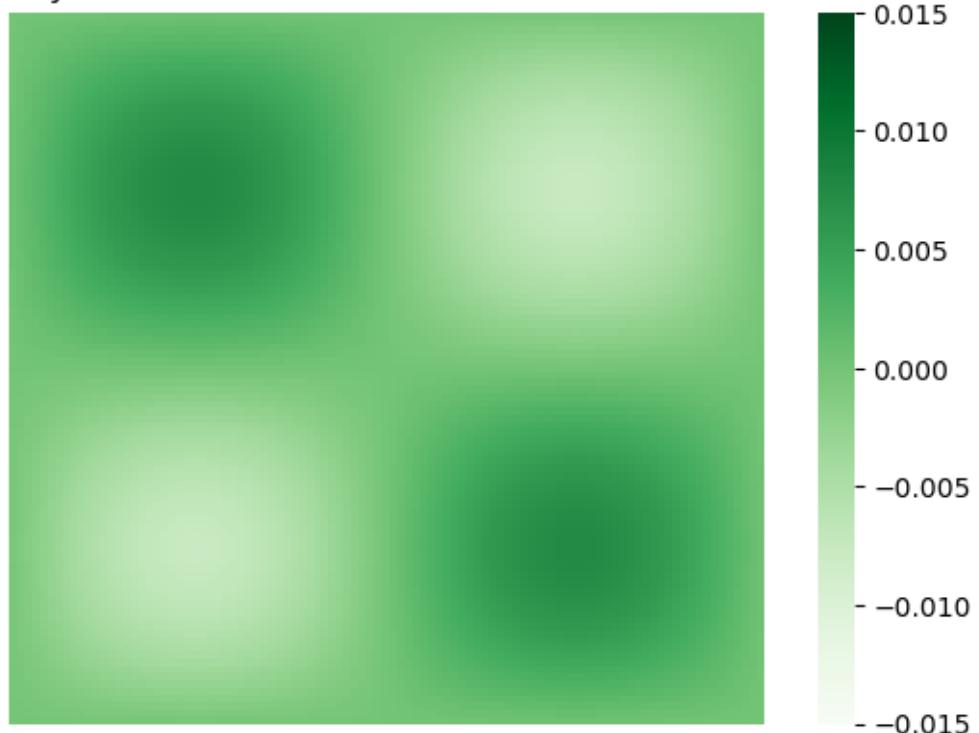
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Analytical Solution: Time = 0.405



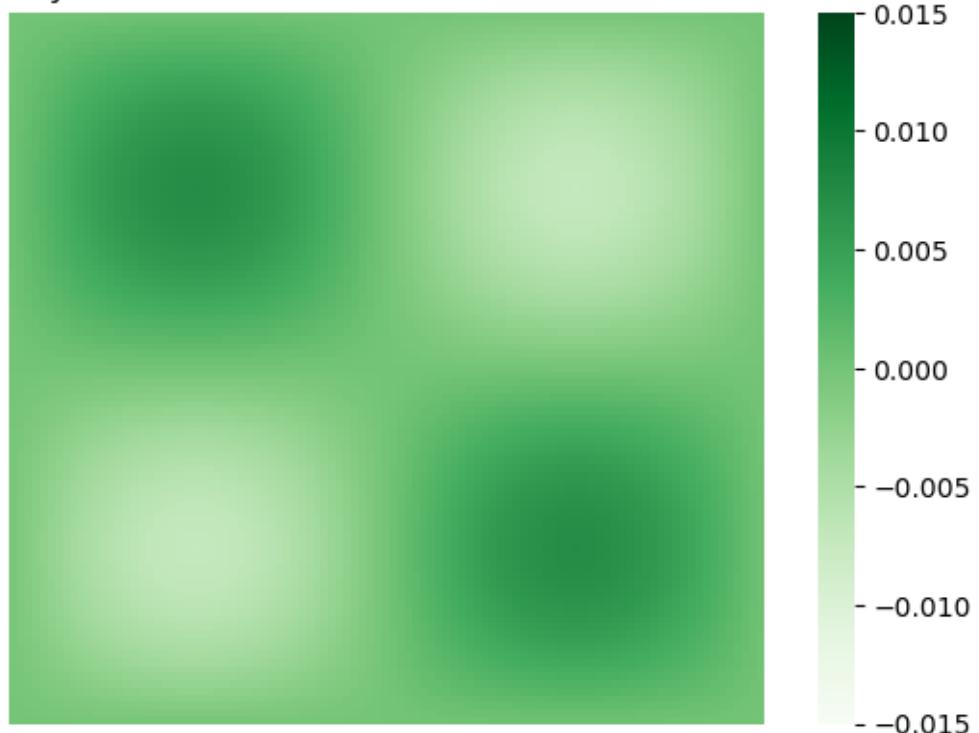
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Analytical Solution: Time = 0.4100000000000003



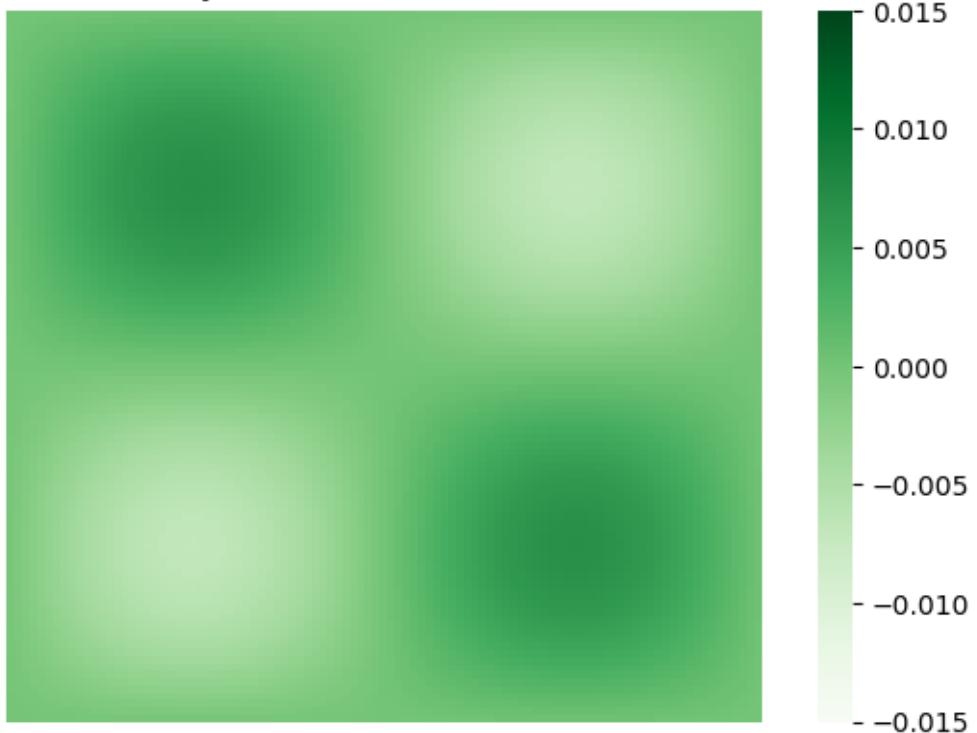
Q_4_Analytical_Solution_at_time_0.415000_.csv

Analytical Solution: Time = 0.4150000000000004



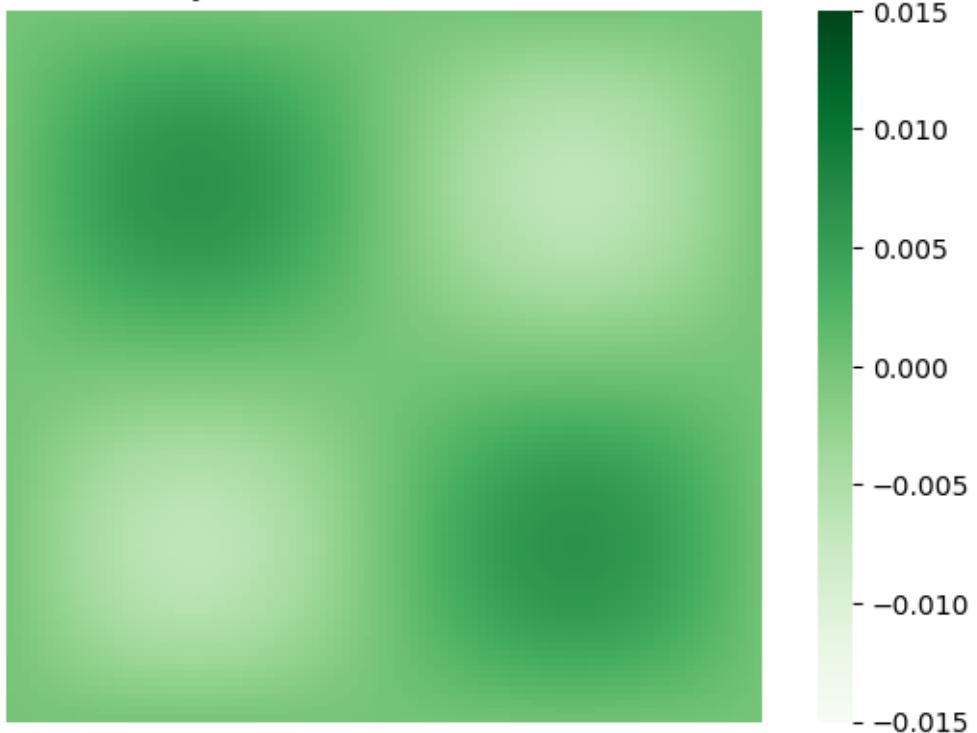
Q_4_Analytical_Solution_at_time_0.420000_.csv

Analytical Solution: Time = 0.42



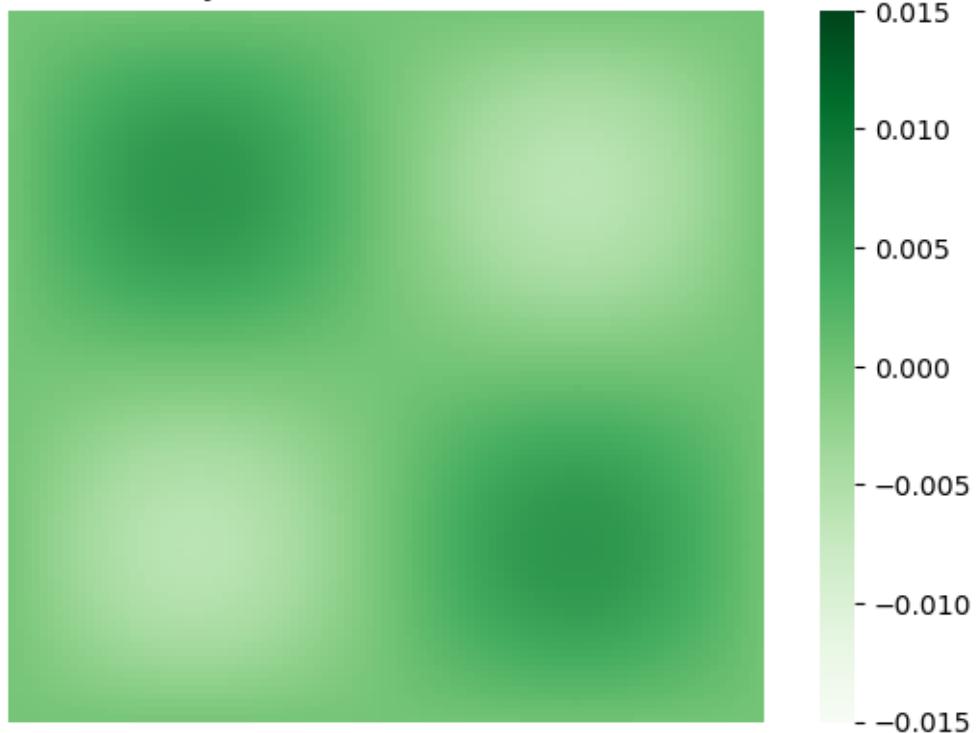
Q_4_Analytical_Solution_at_time_0.425000_.csv

Analytical Solution: Time = 0.425



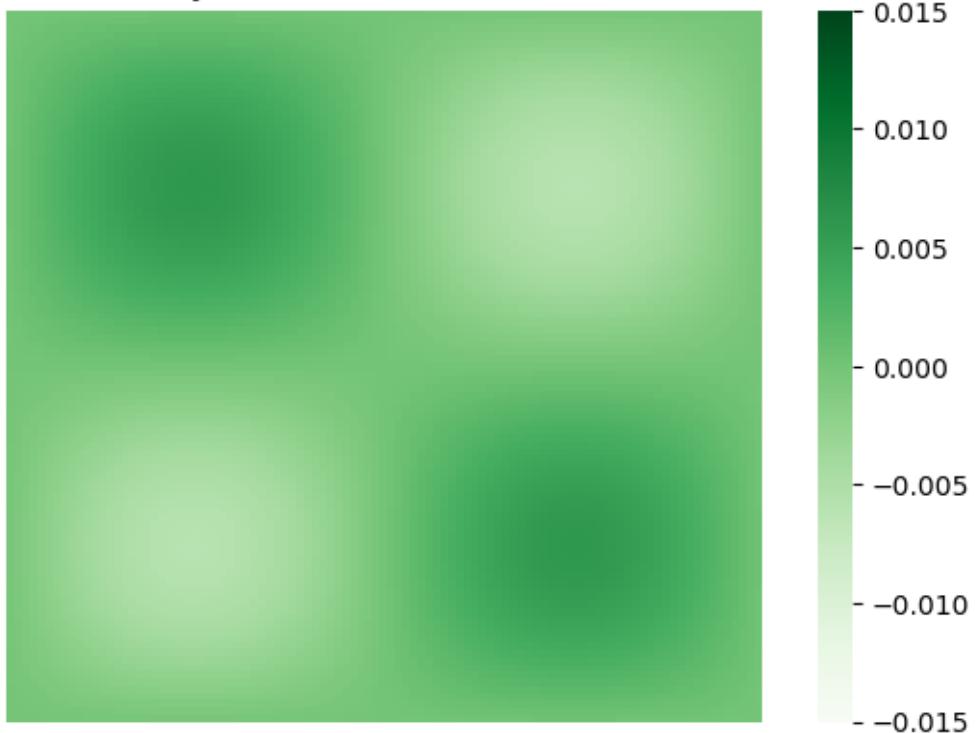
Q_4_Analytical_Solution_at_time_0.430000_.csv

Analytical Solution: Time = 0.43



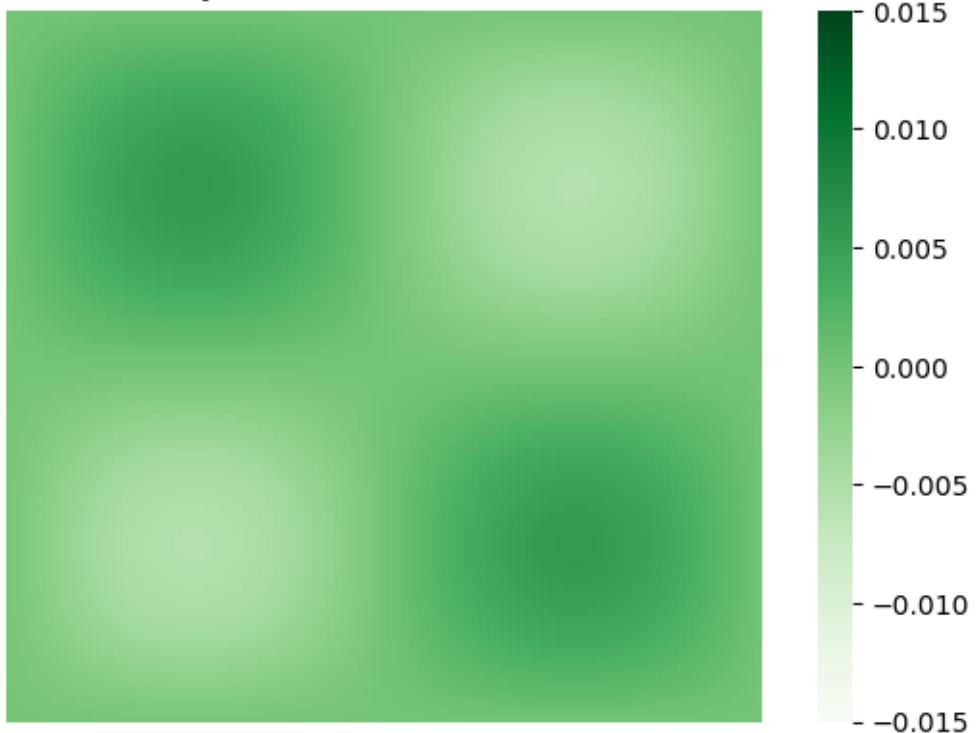
Q_4_Analytical_Solution_at_time_0.435000_.csv

Analytical Solution: Time = 0.435



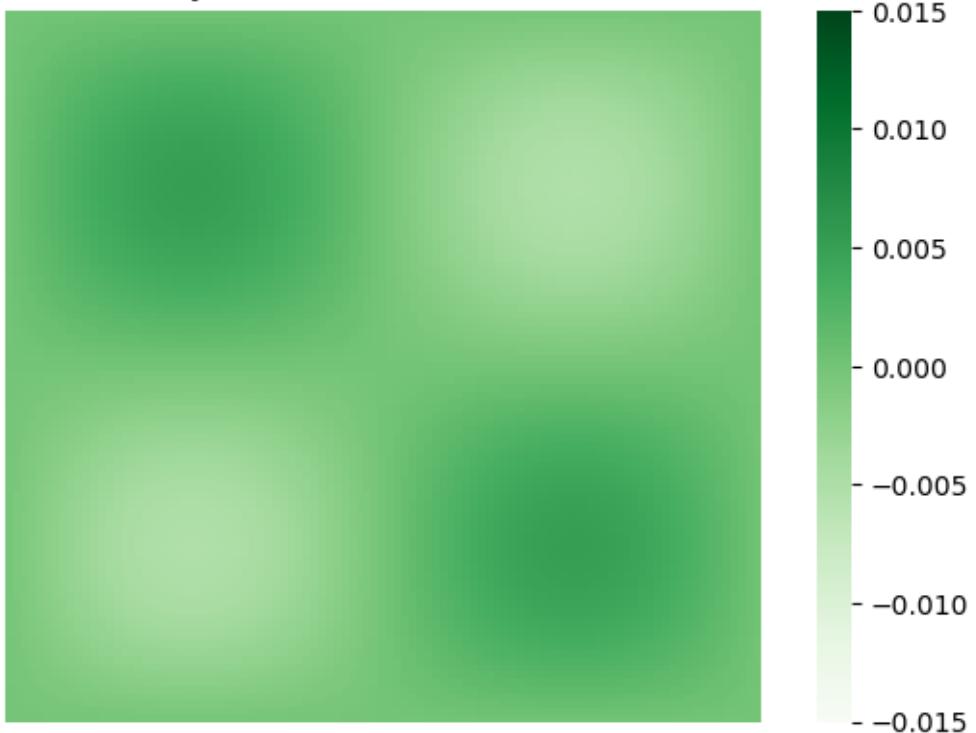
Q_4_Analytical_Solution_at_time_0.440000_.csv

Analytical Solution: Time = 0.44



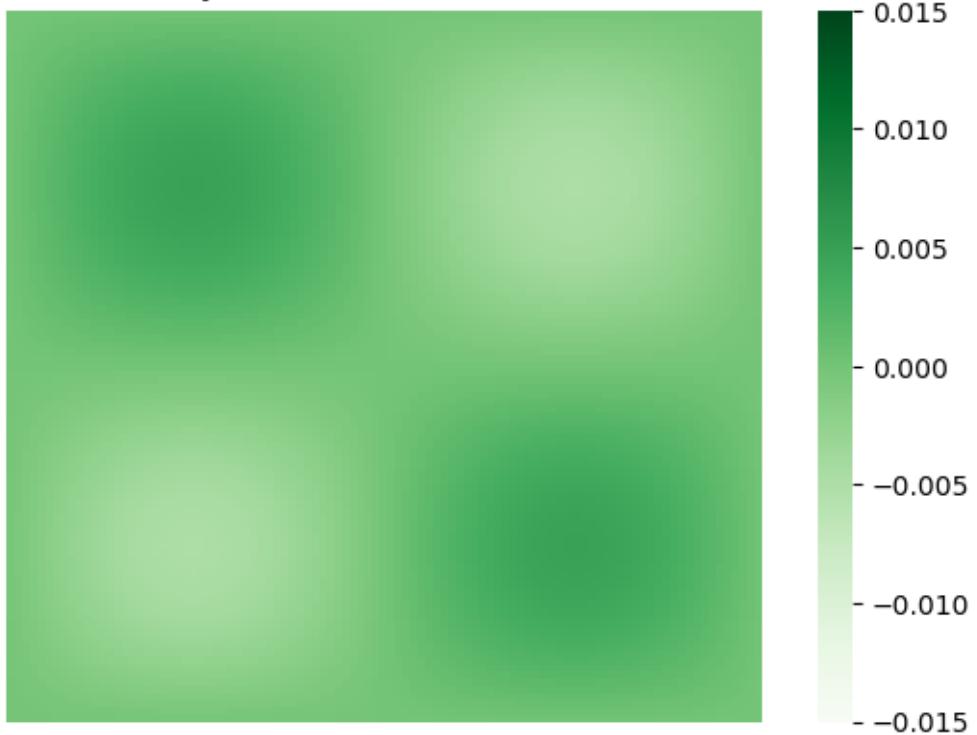
Q_4_Analytical_Solution_at_time_0.445000_.csv

Analytical Solution: Time = 0.445



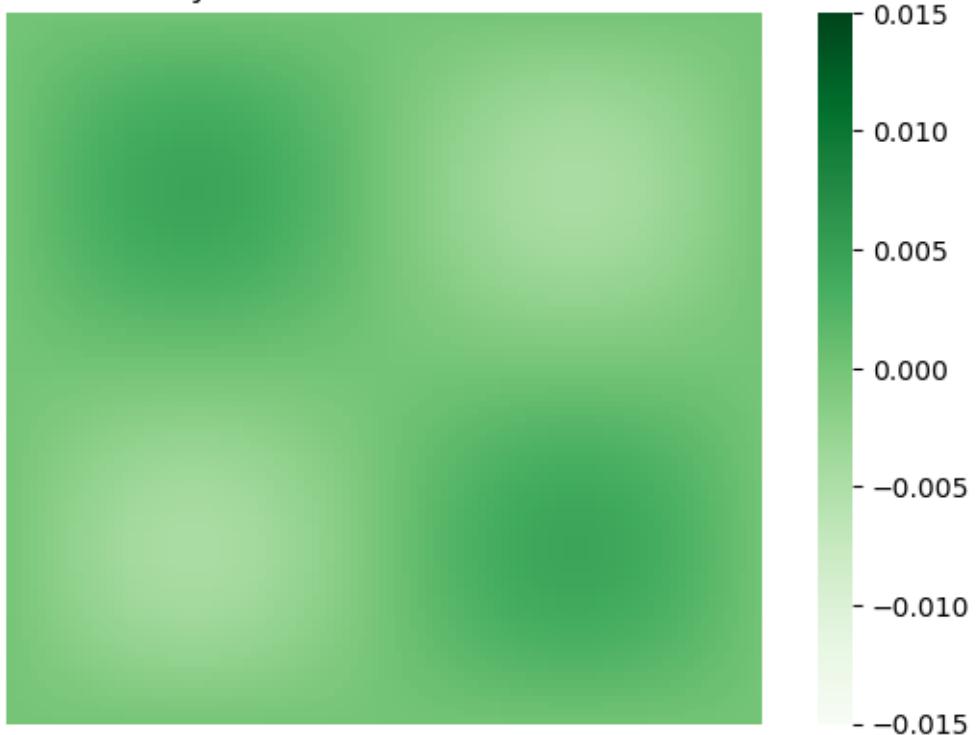
Q_4_Analytical_Solution_at_time_0.450000_.csv

Analytical Solution: Time = 0.45



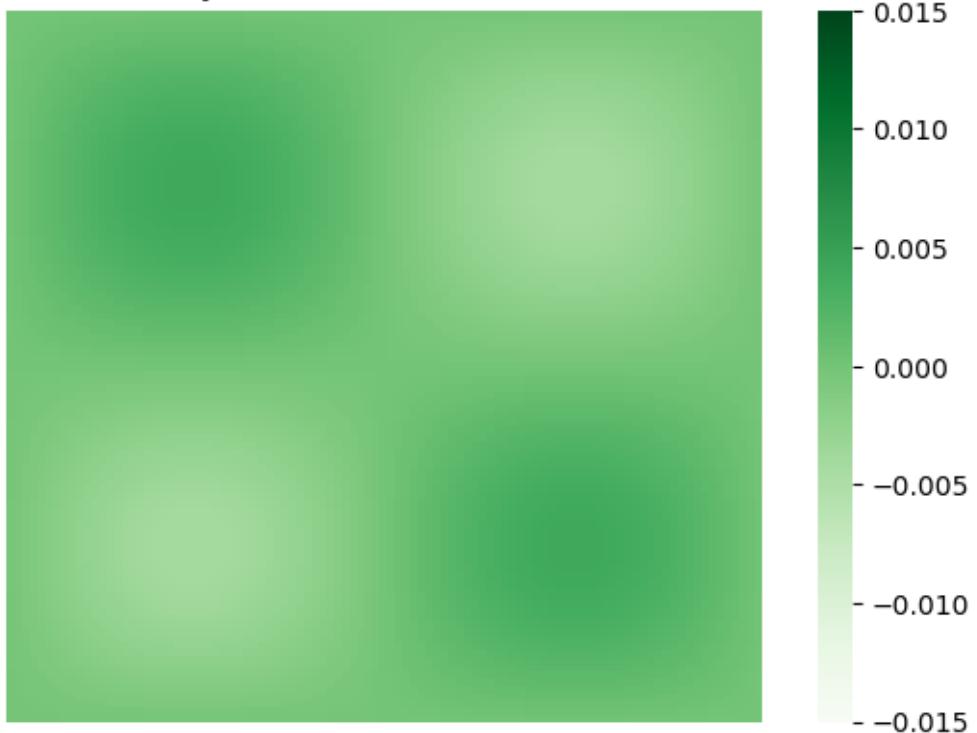
Q_4_Analytical_Solution_at_time_0.455000_.csv

Analytical Solution: Time = 0.455



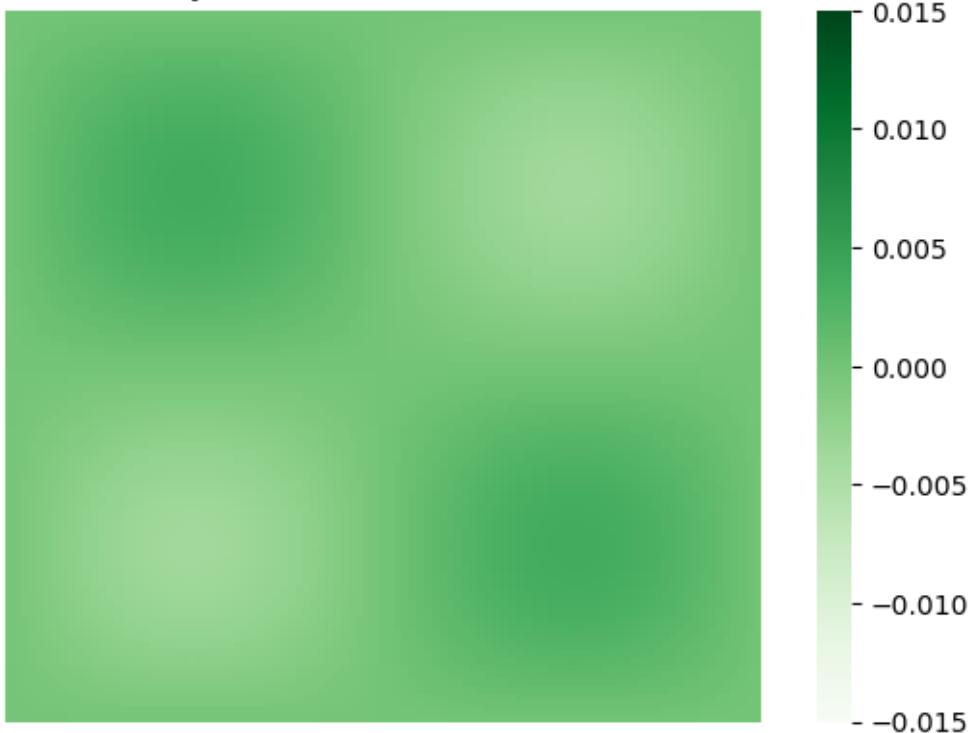
Q_4_Analytical_Solution_at_time_0.460000_.csv

Analytical Solution: Time = 0.46



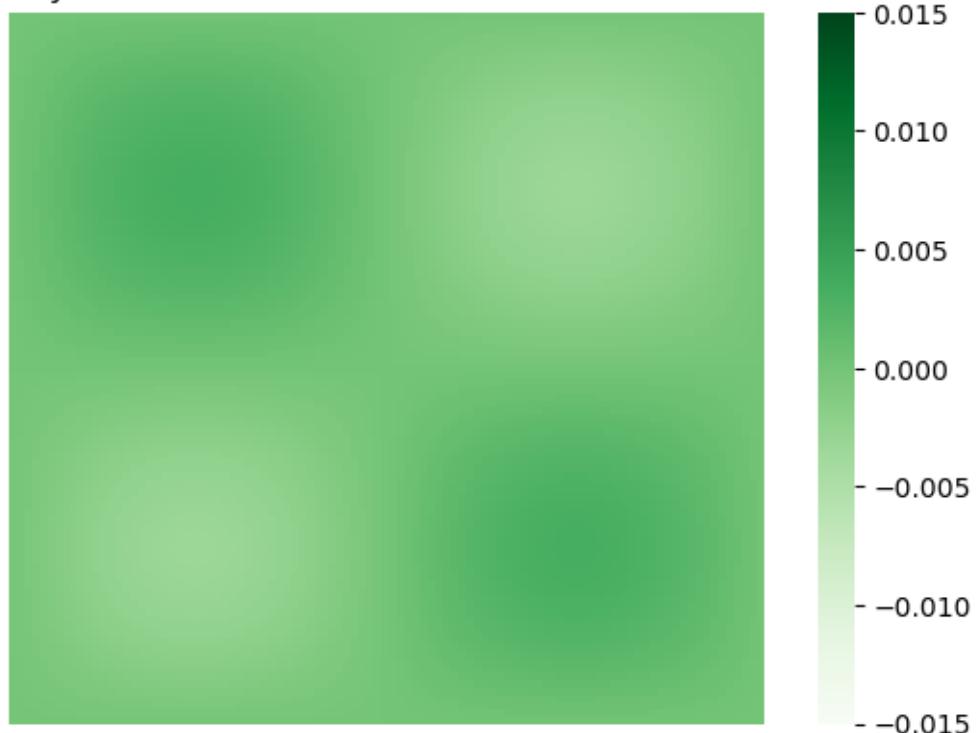
Q_4_Analytical_Solution_at_time_0.465000_.csv

Analytical Solution: Time = 0.465



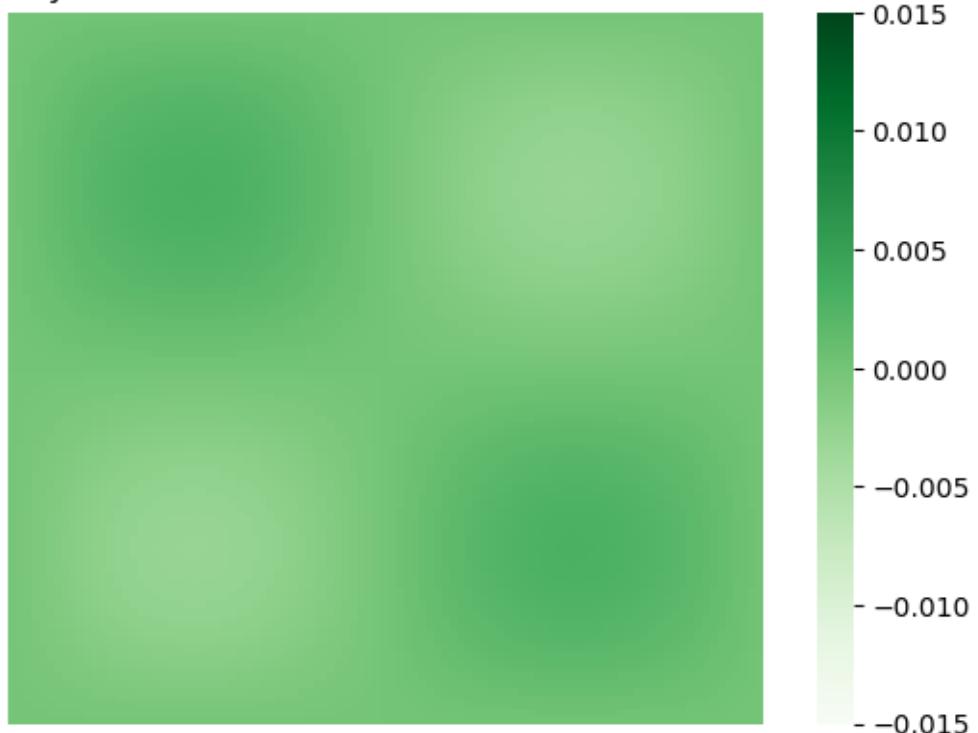
Q_4_Analytical_Solution_at_time_0.470000_.csv

Analytical Solution: Time = 0.4700000000000003



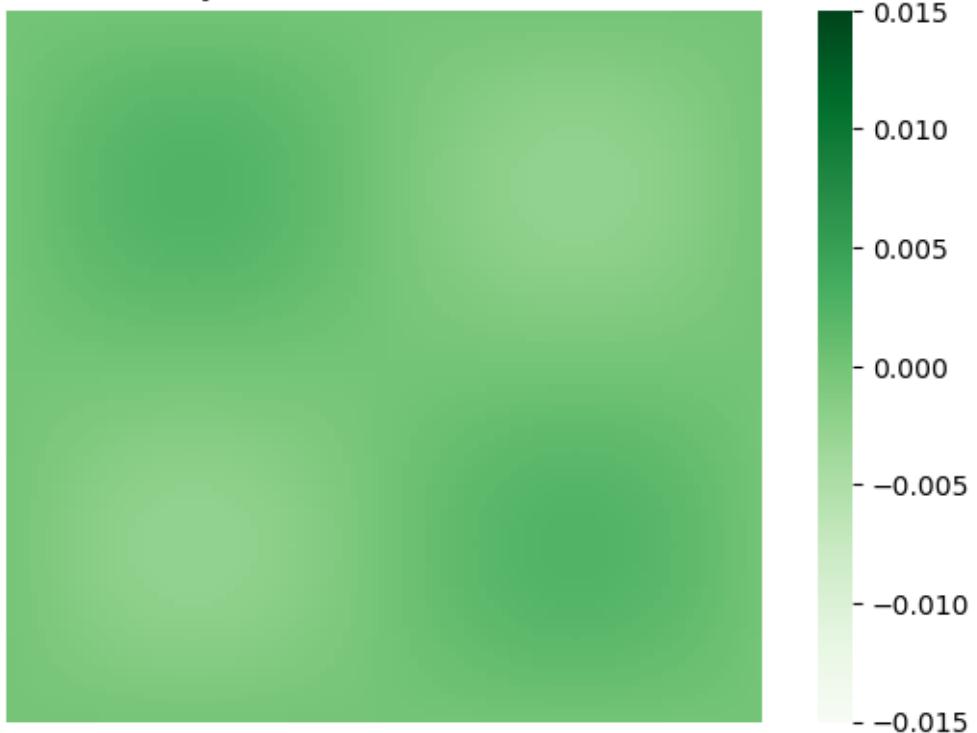
Q_4_Analytical_Solution_at_time_0.475000_.csv

Analytical Solution: Time = 0.47500000000000003



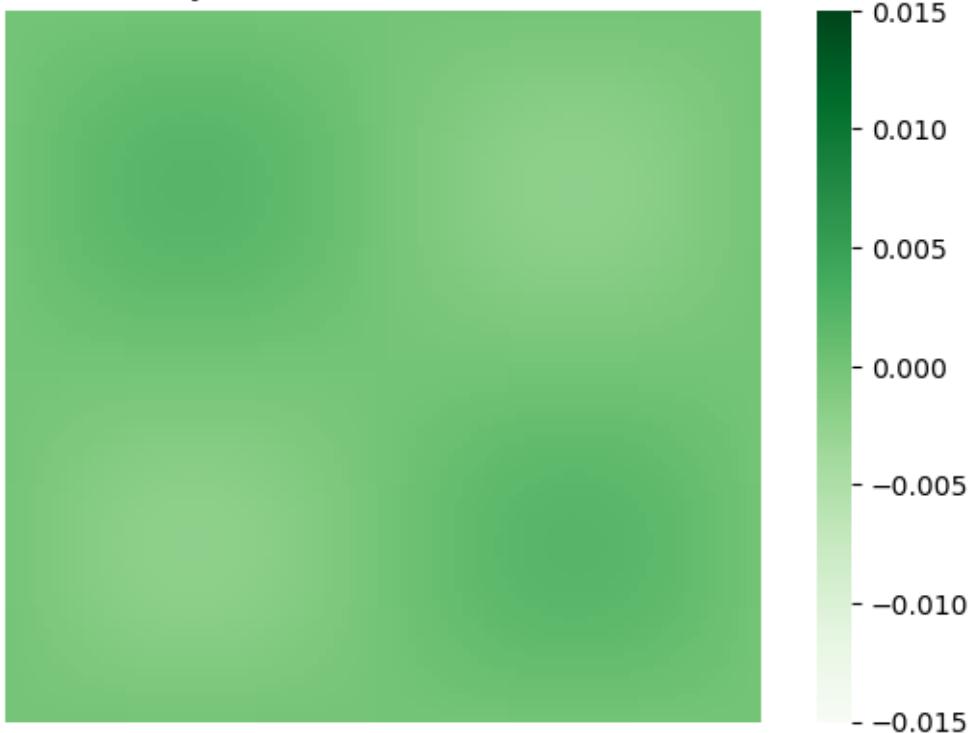
Q_4_Analytical_Solution_at_time_0.480000_.csv

Analytical Solution: Time = 0.48



Q_4_Analytical_Solution_at_time_0.485000_.csv

Analytical Solution: Time = 0.485



Q_4_Analytical_Solution_at_time_0.490000_.csv

Analytical Solution: Time = 0.49



Q_4_Analytical_Solution_at_time_0.495000_.csv

Analytical Solution: Time = 0.495



Q_4_Analytical_Solution_at_time_0.500000_.csv

Analytical Solution: Time = 0.5



Q_4_Analytical_Solution_at_time_0.505000_.csv

Analytical Solution: Time = 0.505



Q_4_Analytical_Solution_at_time_0.510000_.csv

Analytical Solution: Time = 0.51



Q_4_Analytical_Solution_at_time_0.515000_.csv

Analytical Solution: Time = 0.515



Q_4_Analytical_Solution_at_time_0.520000_.csv

Analytical Solution: Time = 0.52



Q_4_Analytical_Solution_at_time_0.525000_.csv

Analytical Solution: Time = 0.525



Q_4_Analytical_Solution_at_time_0.530000_.csv

Analytical Solution: Time = 0.53



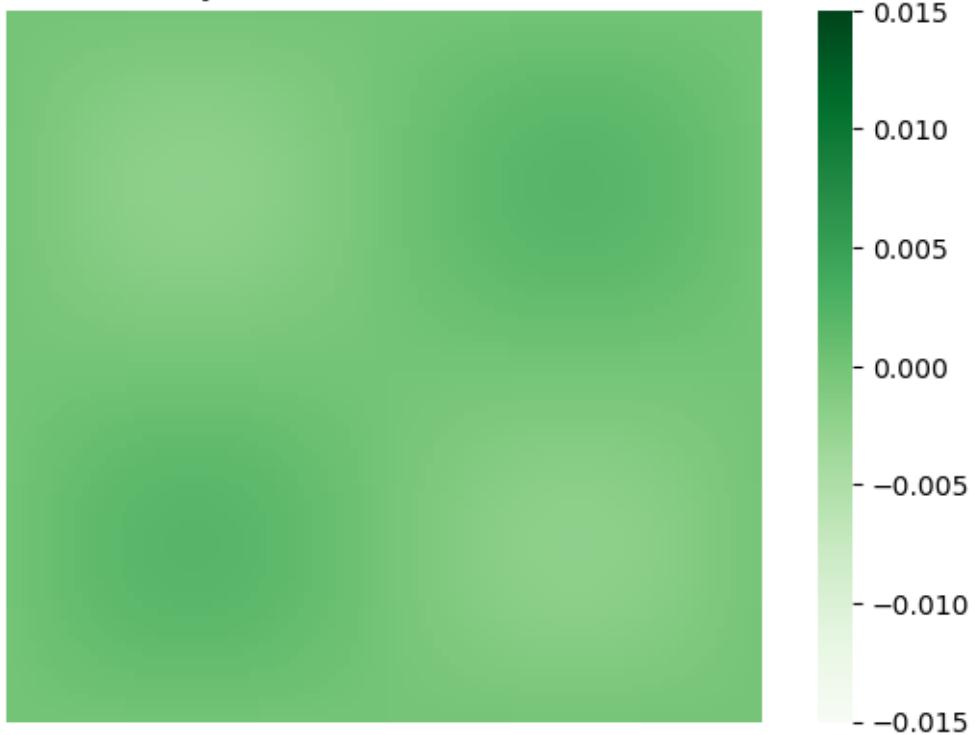
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Analytical Solution: Time = 0.535



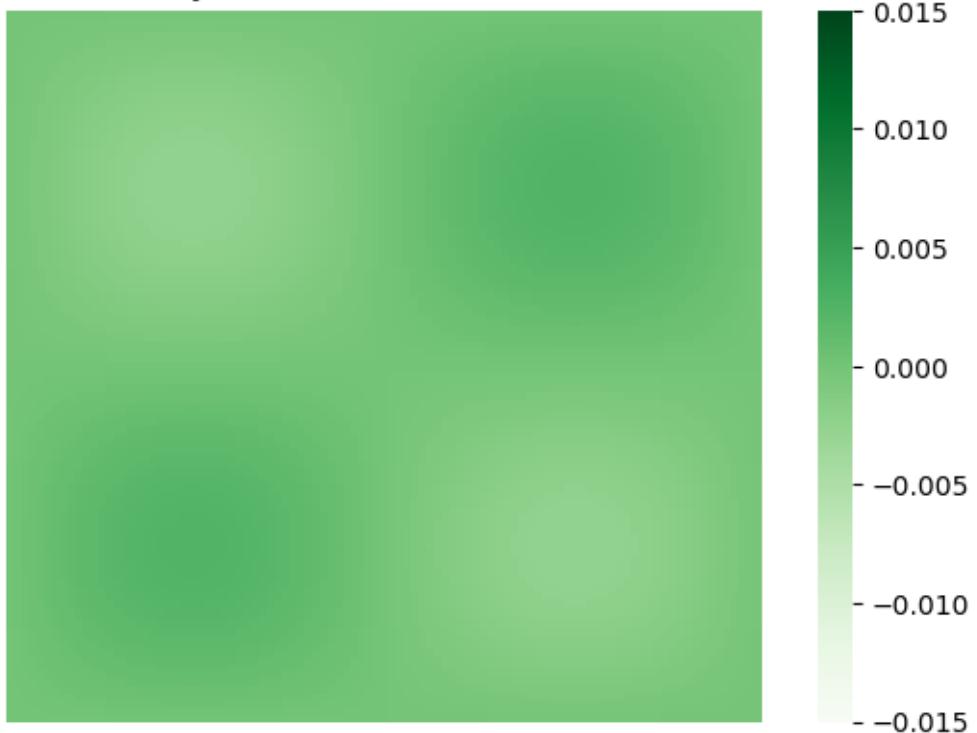
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Analytical Solution: Time = 0.54



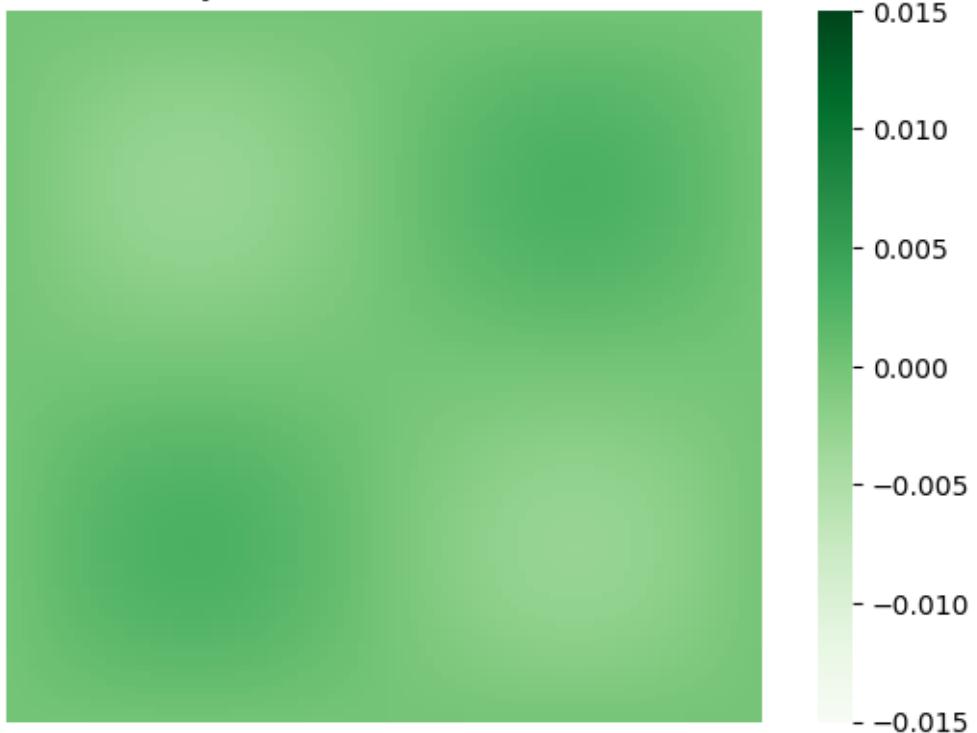
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Analytical Solution: Time = 0.545



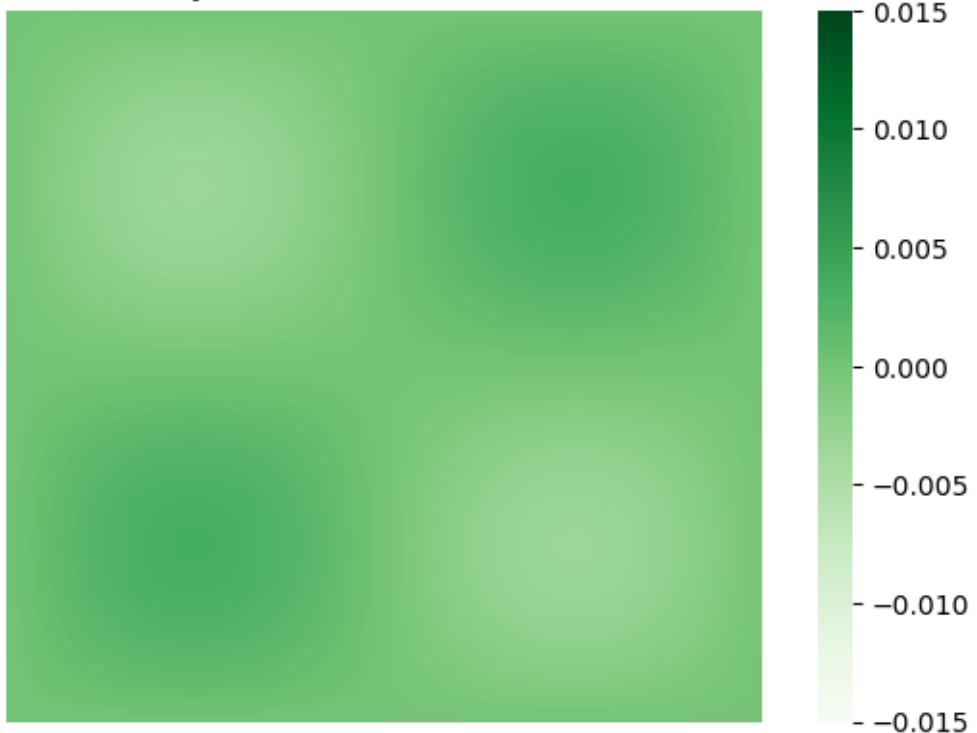
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Analytical Solution: Time = 0.55



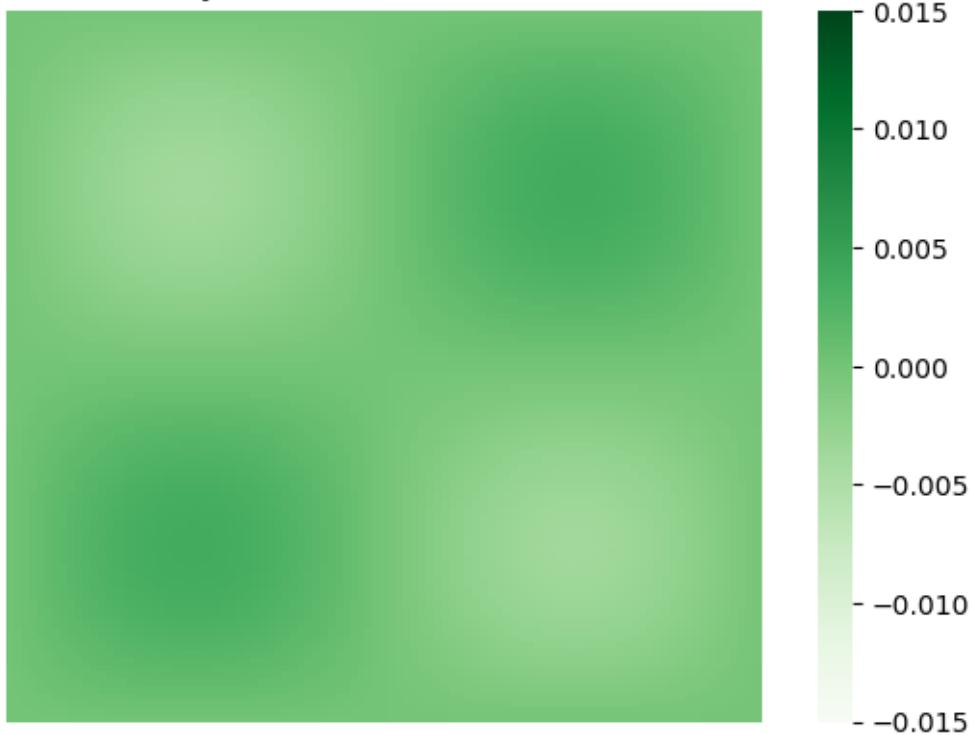
Q_4_Analytical_Solution_at_time_0.555000_.csv

Analytical Solution: Time = 0.555



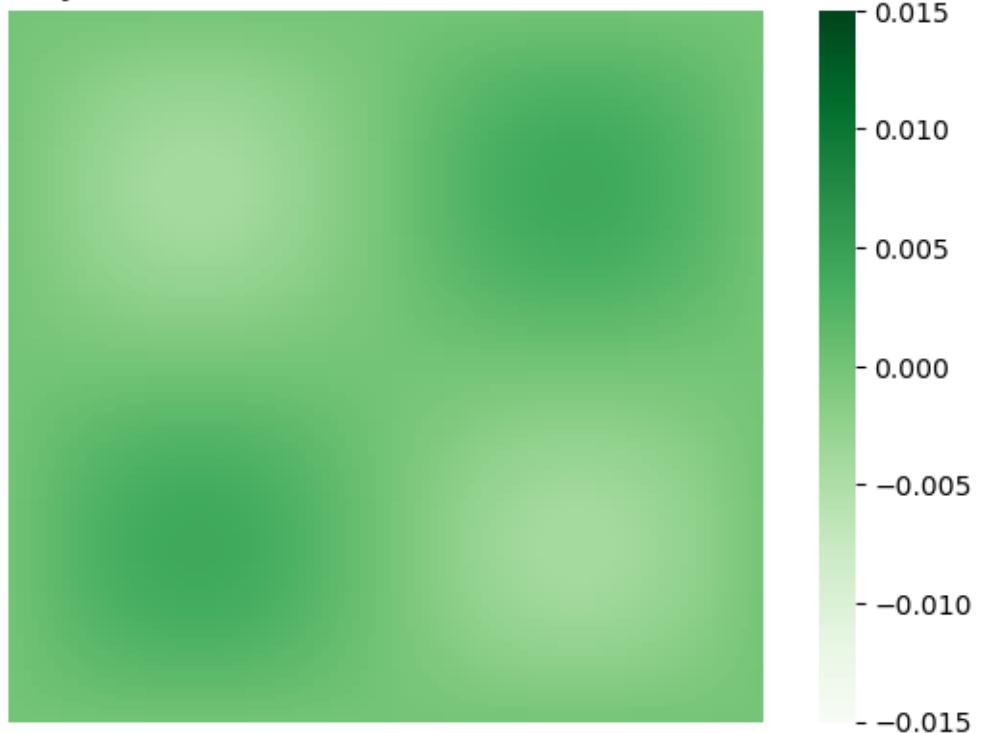
Q_4_Analytical_Solution_at_time_0.560000_.csv

Analytical Solution: Time = 0.56



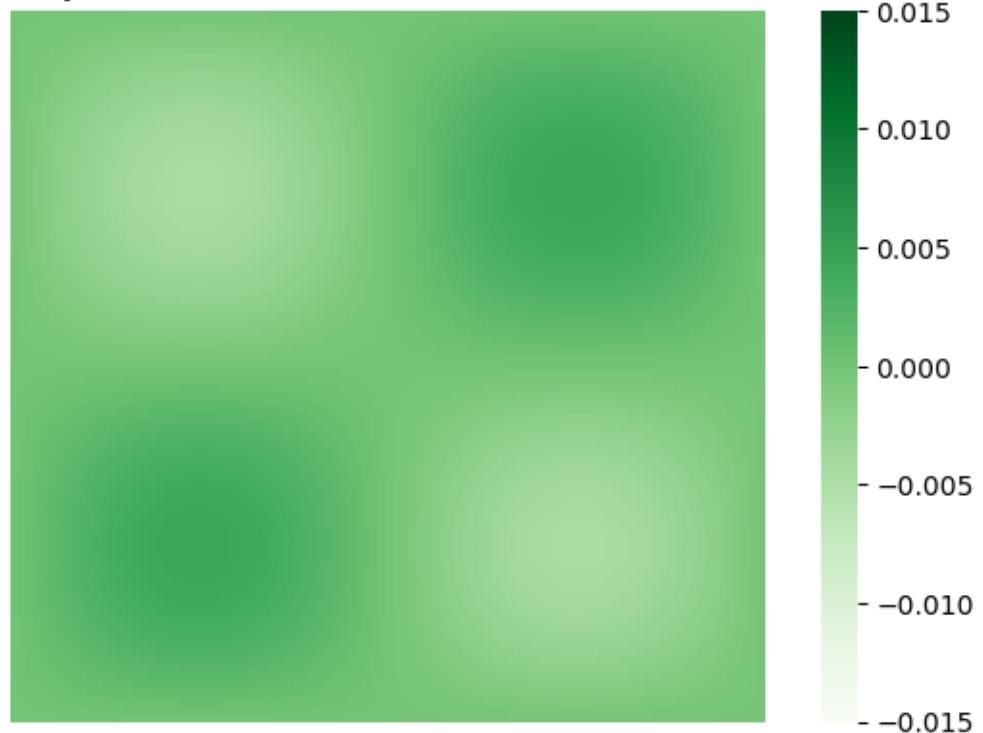
Q_4_Analytical_Solution_at_time_0.565000_.csv

Analytical Solution: Time = 0.5650000000000001



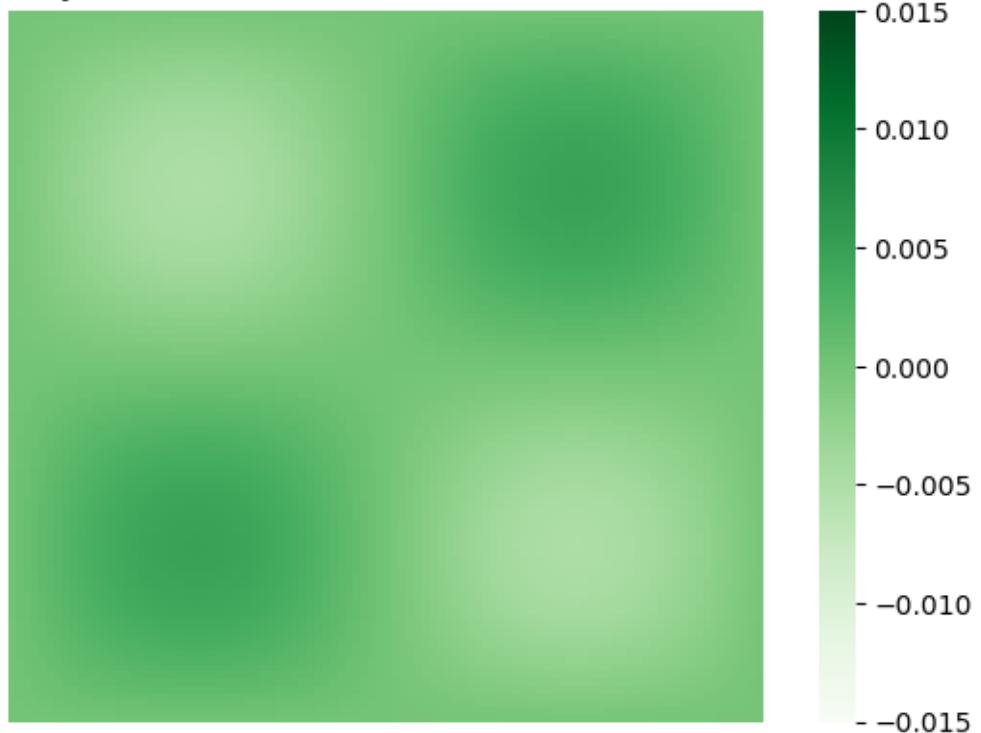
Q_4_Analytical_Solution_at_time_0.570000_.csv

Analytical Solution: Time = 0.5700000000000001



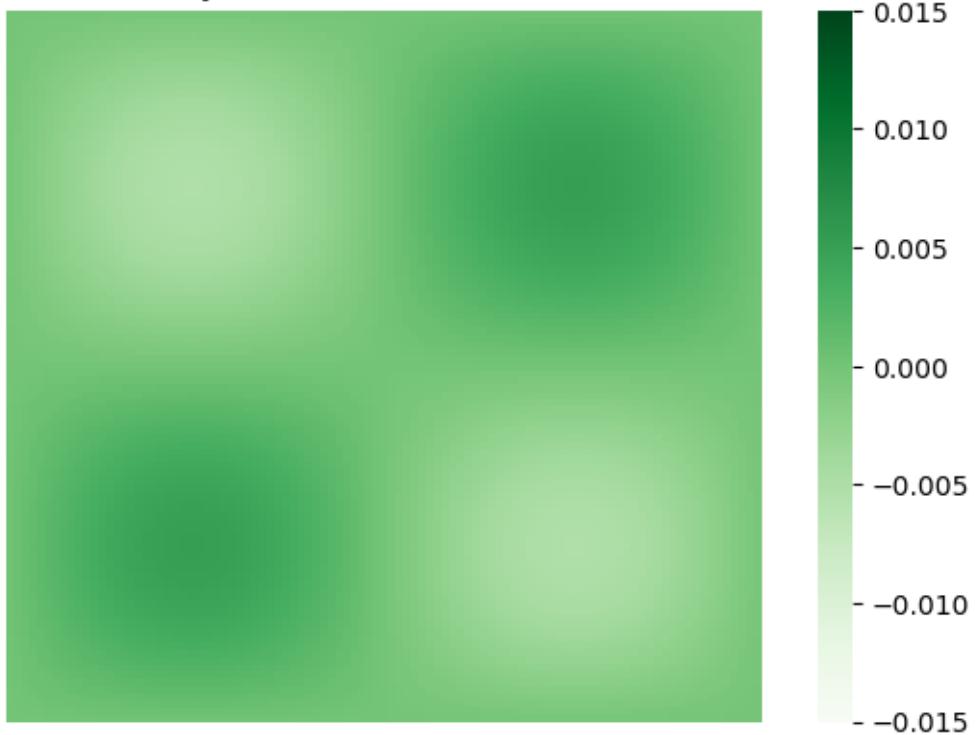
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Analytical Solution: Time = 0.5750000000000001



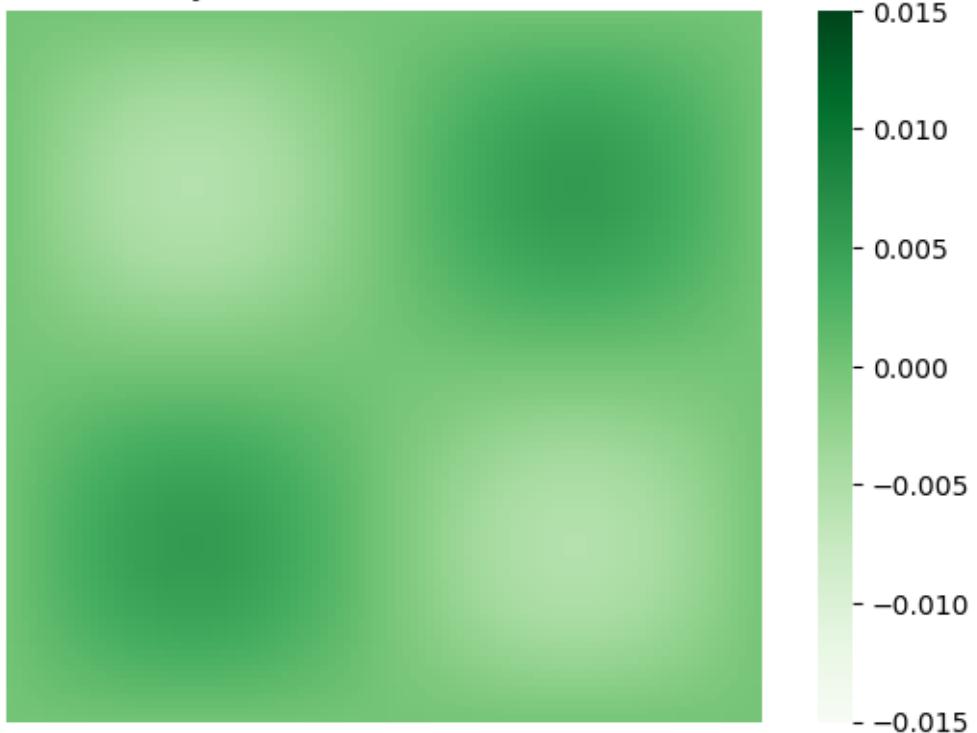
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Analytical Solution: Time = 0.58



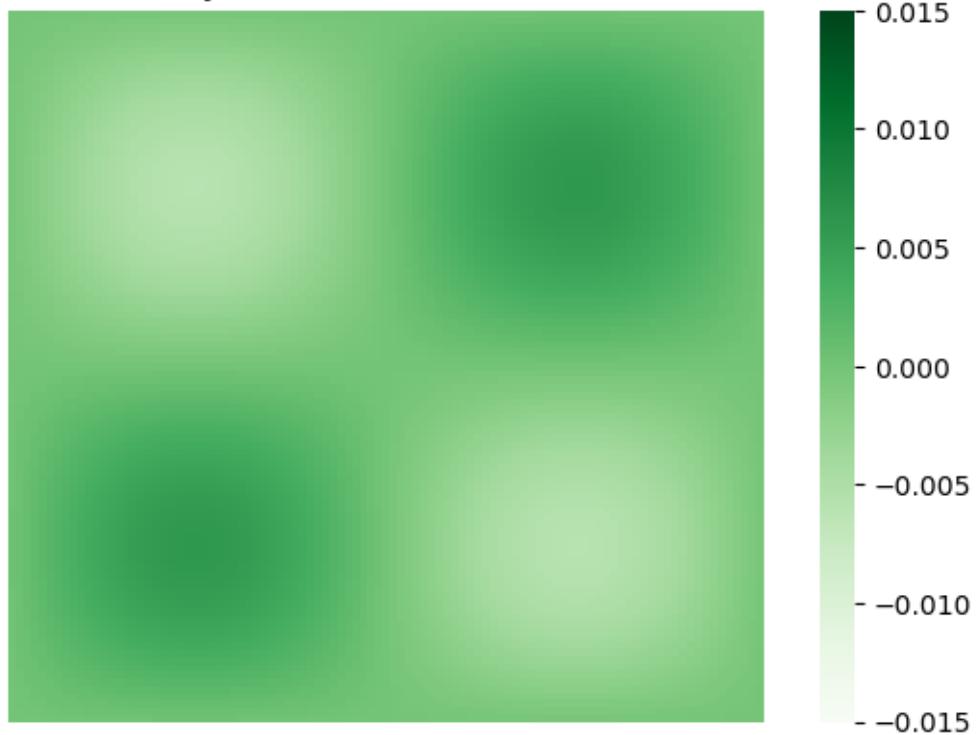
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Analytical Solution: Time = 0.585



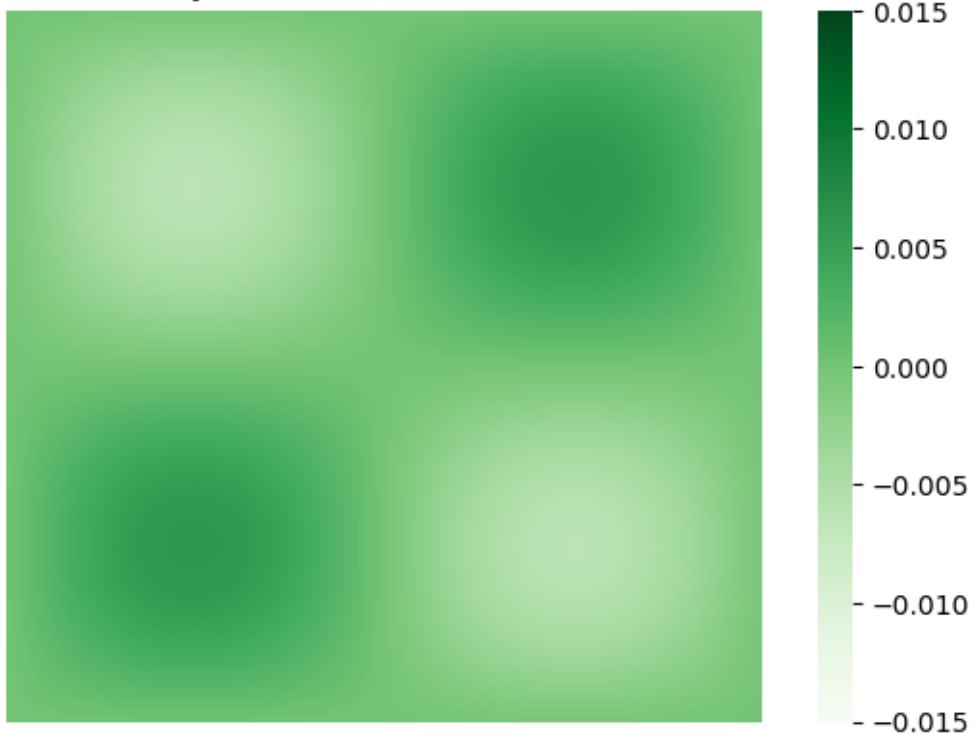
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Analytical Solution: Time = 0.59



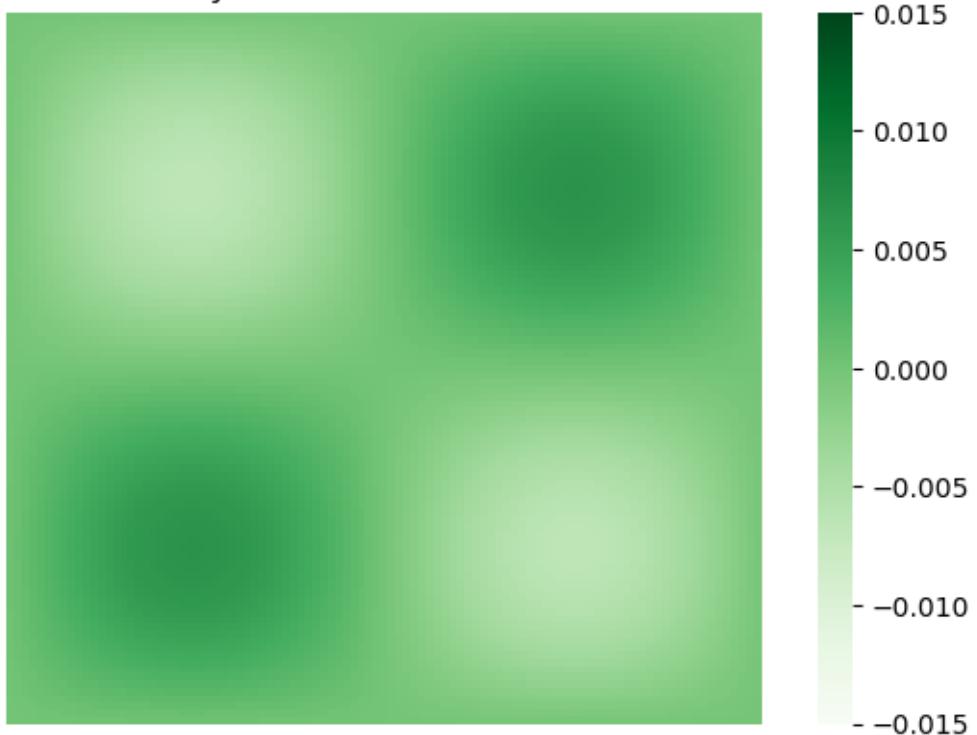
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Analytical Solution: Time = 0.595



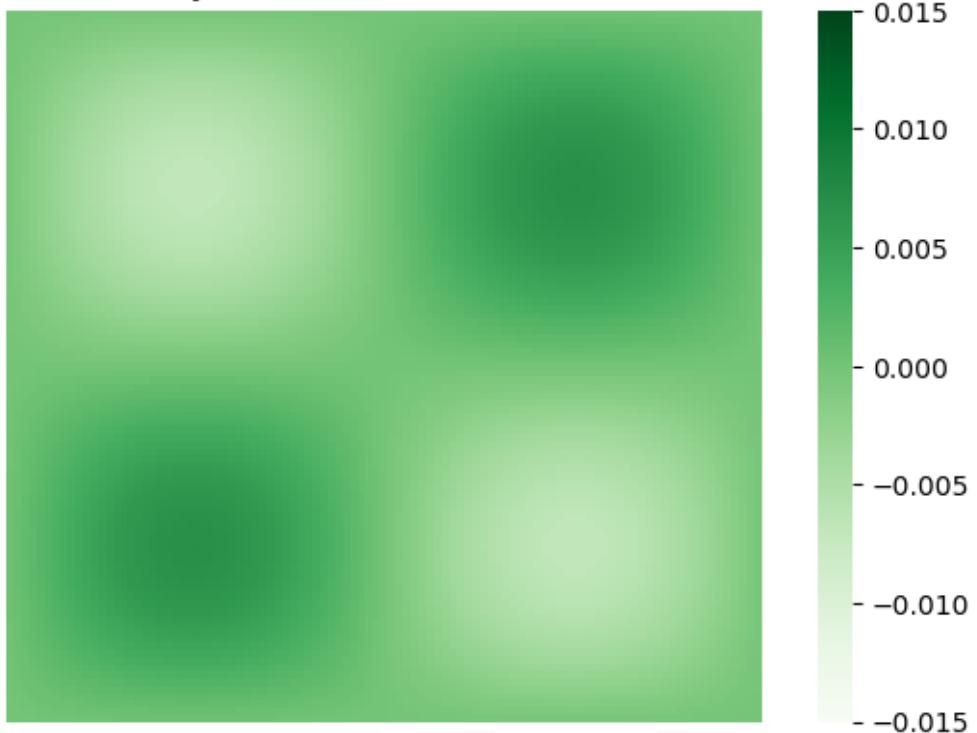
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Analytical Solution: Time = 0.6



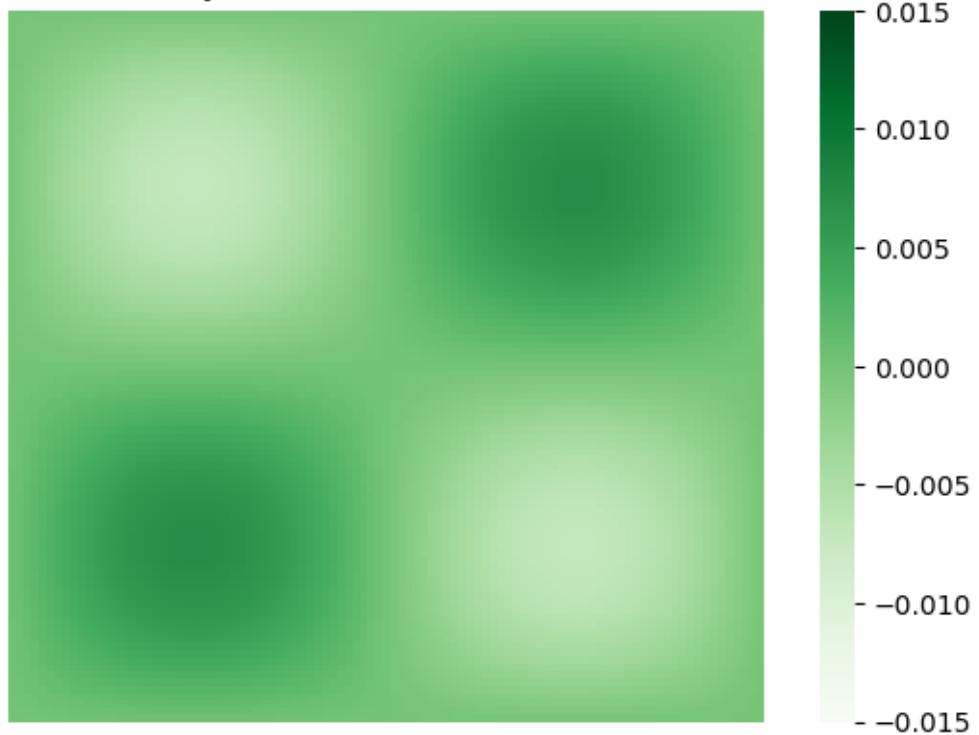
Q_4_Analytical_Solution_at_time_0.605000_.csv

Analytical Solution: Time = 0.605



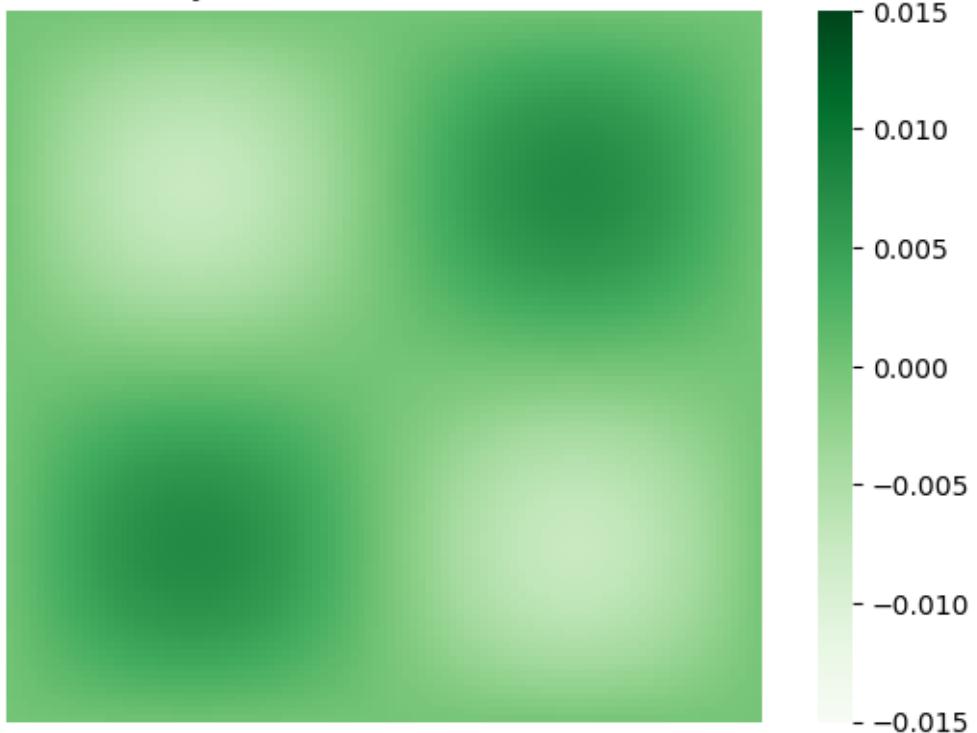
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Analytical Solution: Time = 0.61



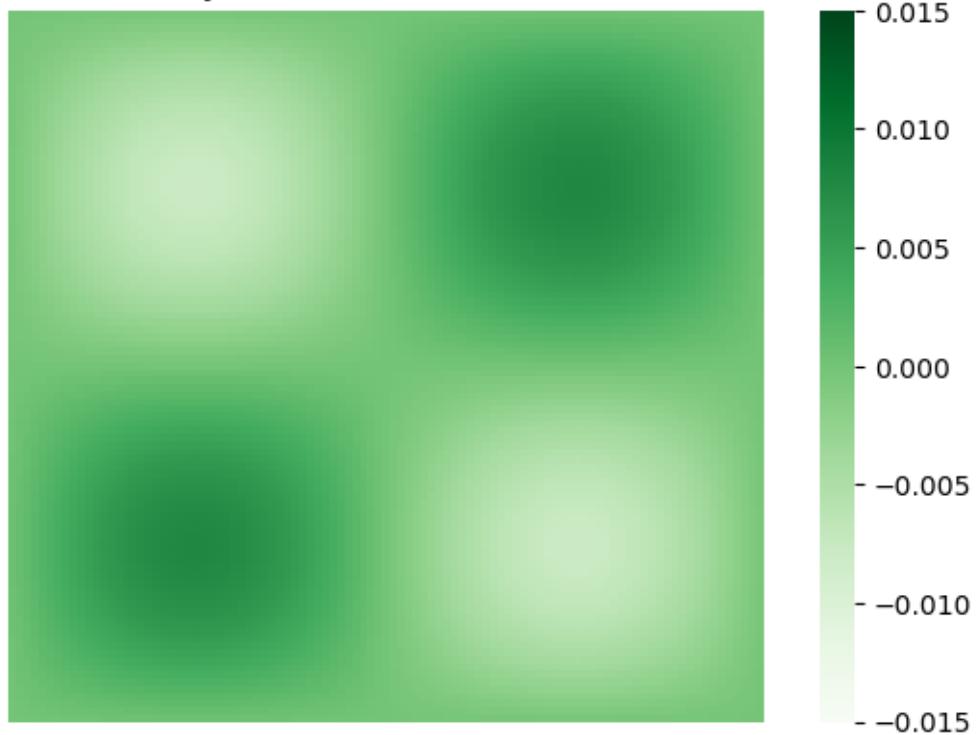
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Analytical Solution: Time = 0.615



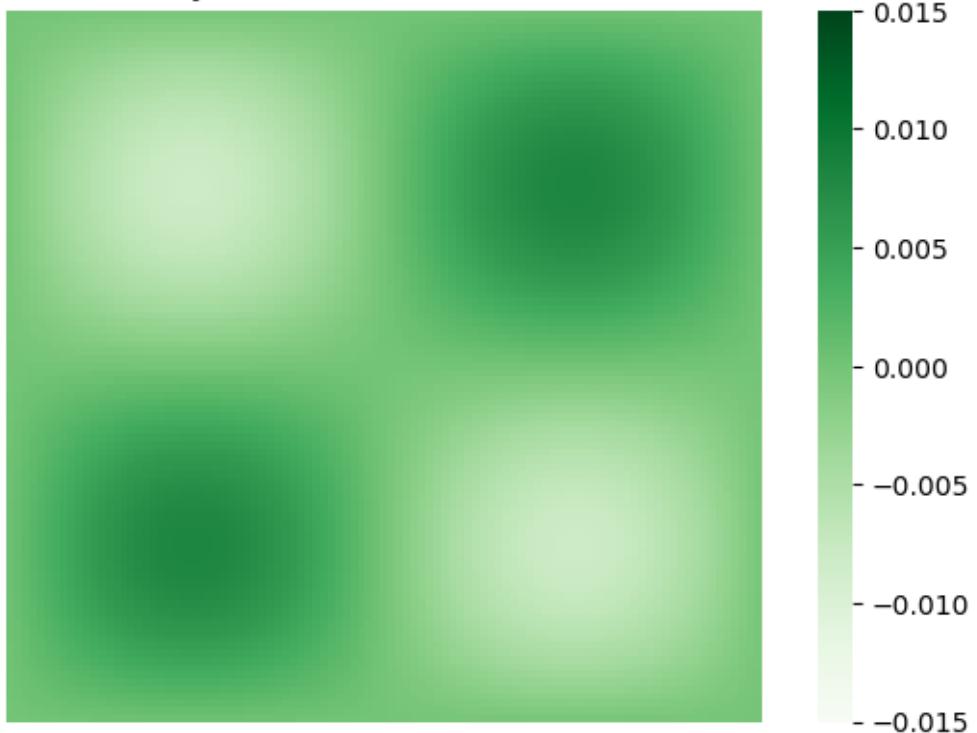
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Analytical Solution: Time = 0.62



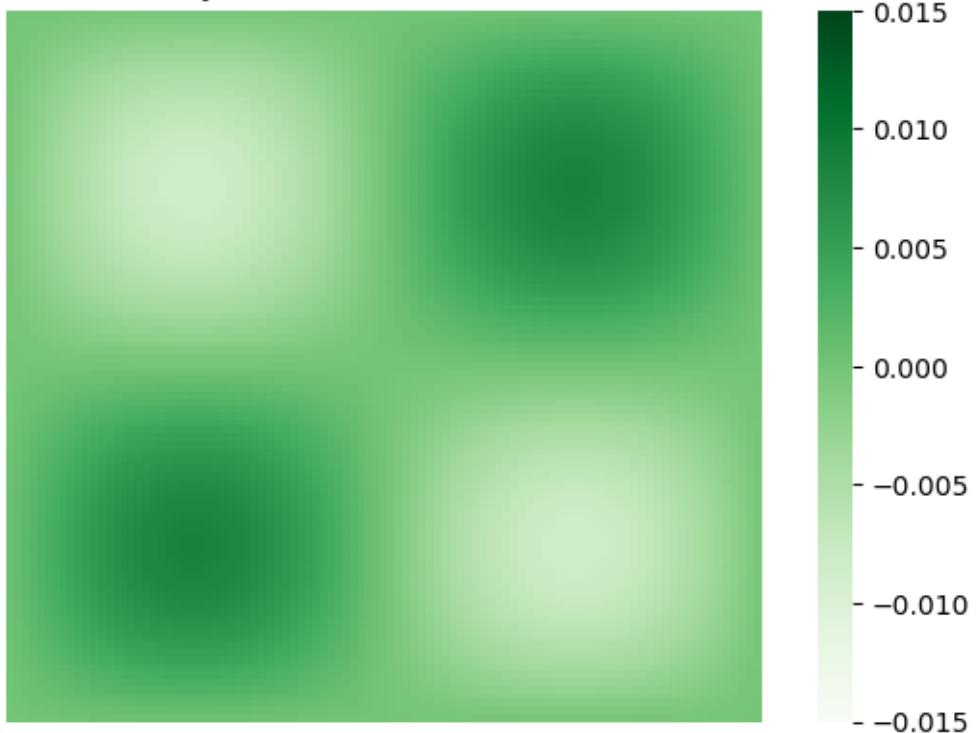
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Analytical Solution: Time = 0.625



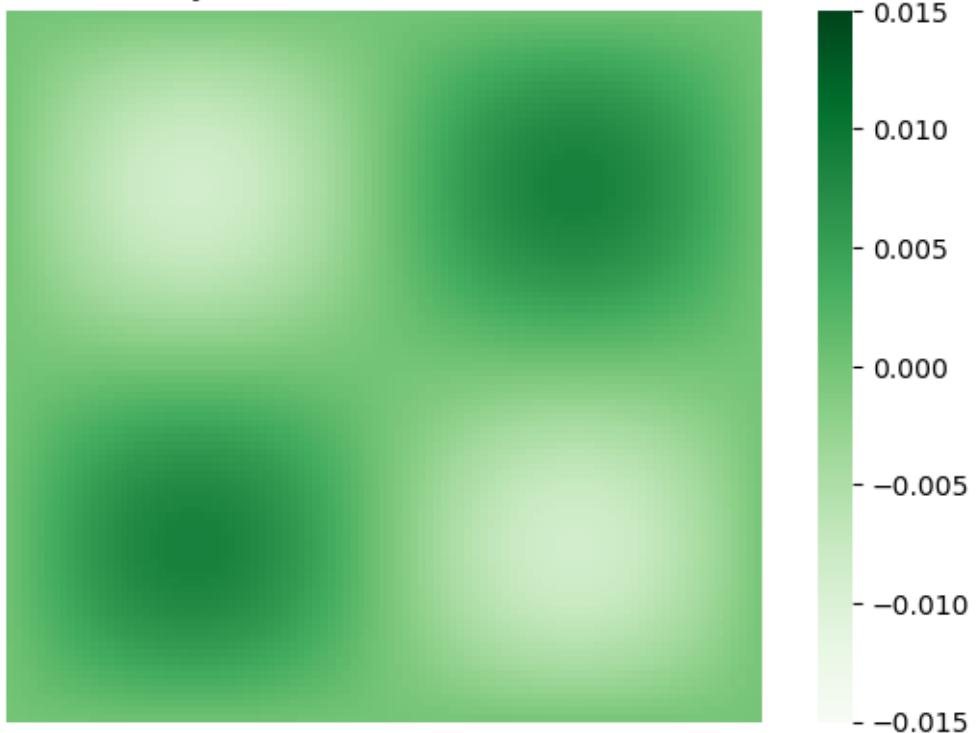
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Analytical Solution: Time = 0.63



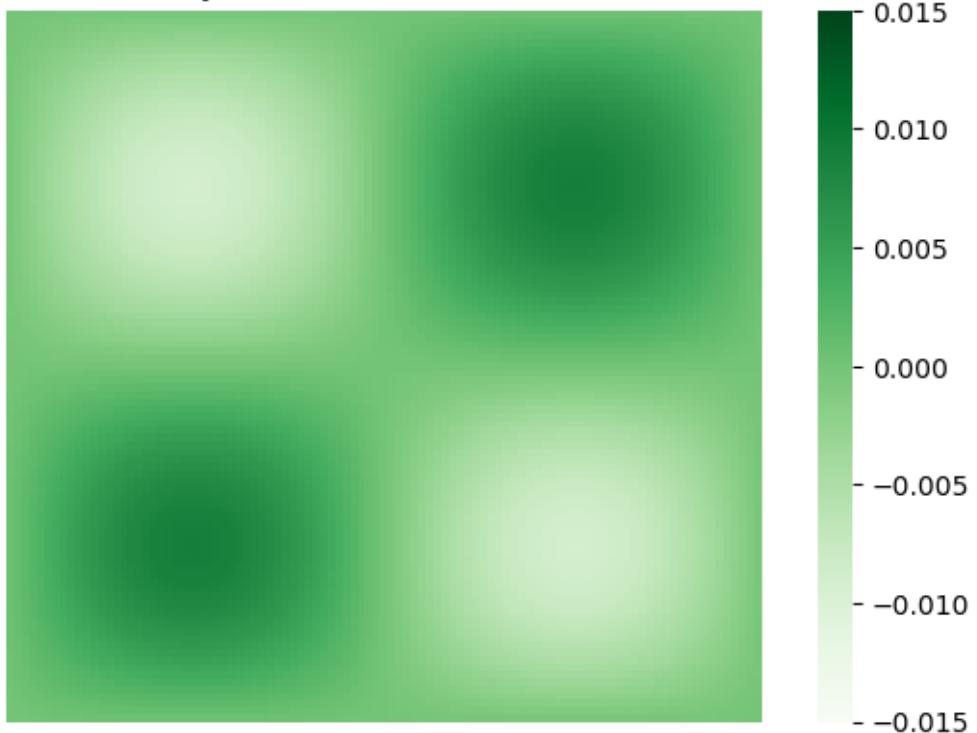
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Analytical Solution: Time = 0.635



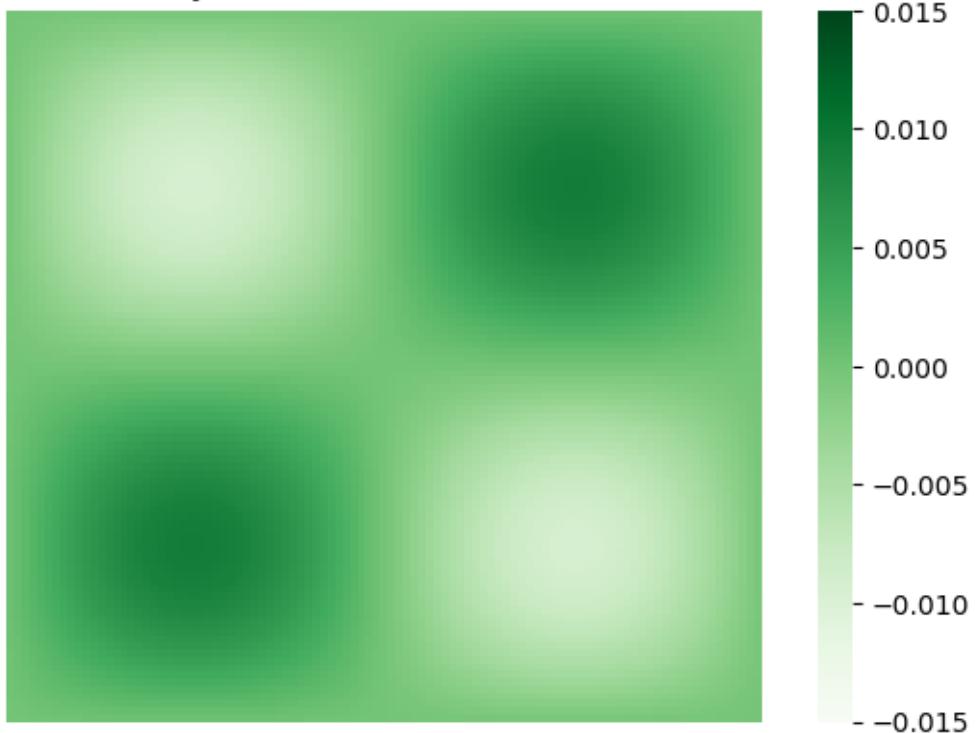
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Analytical Solution: Time = 0.64



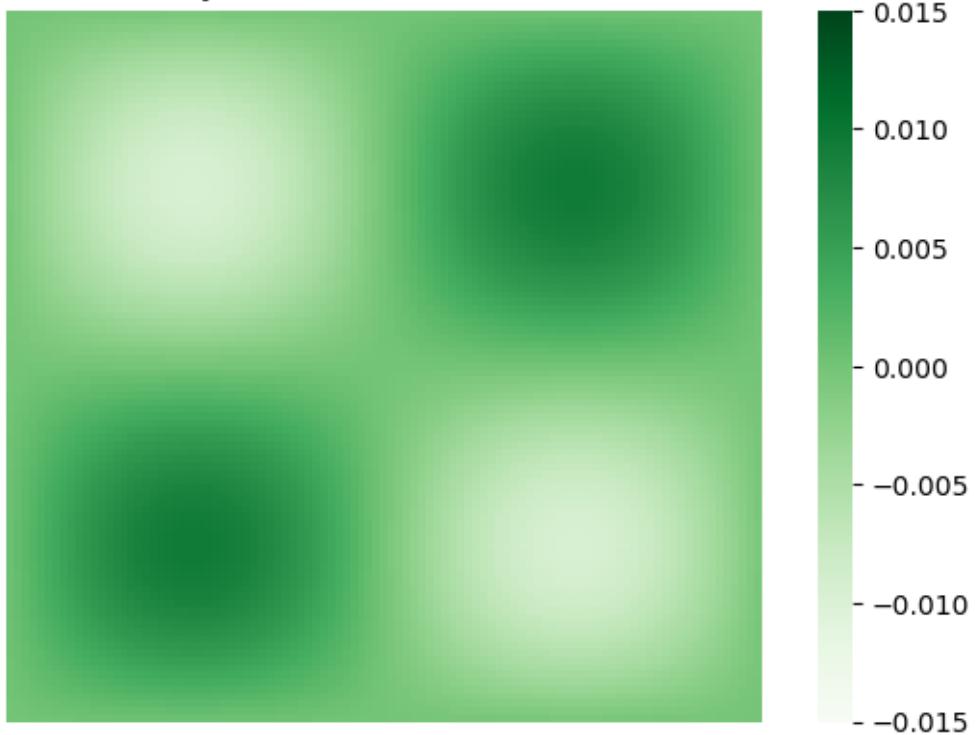
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Analytical Solution: Time = 0.645



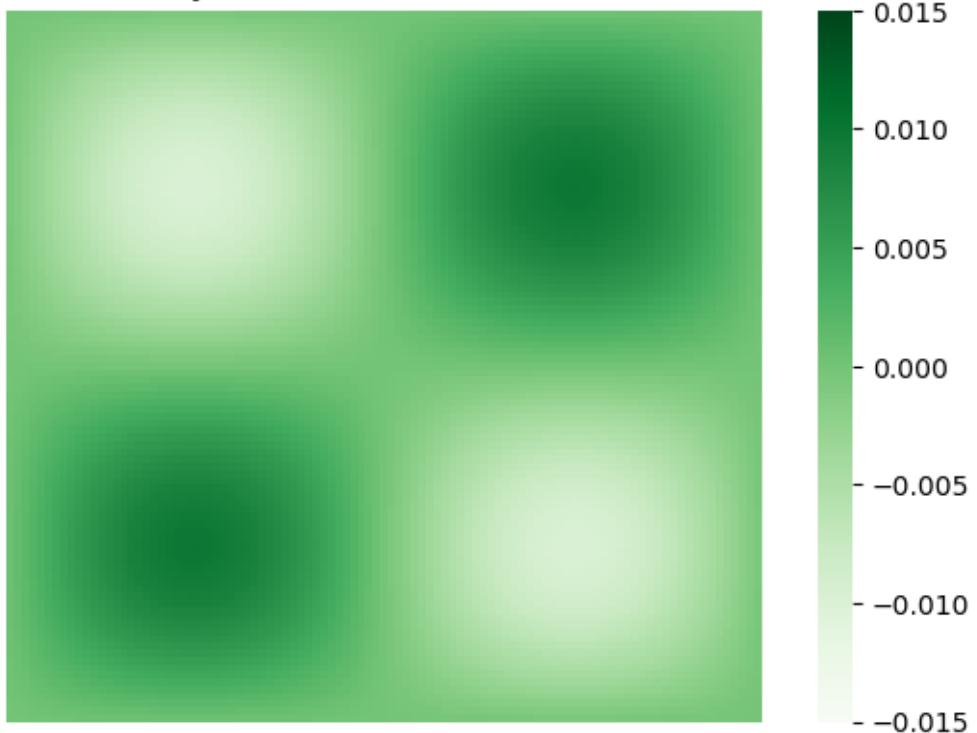
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Analytical Solution: Time = 0.65



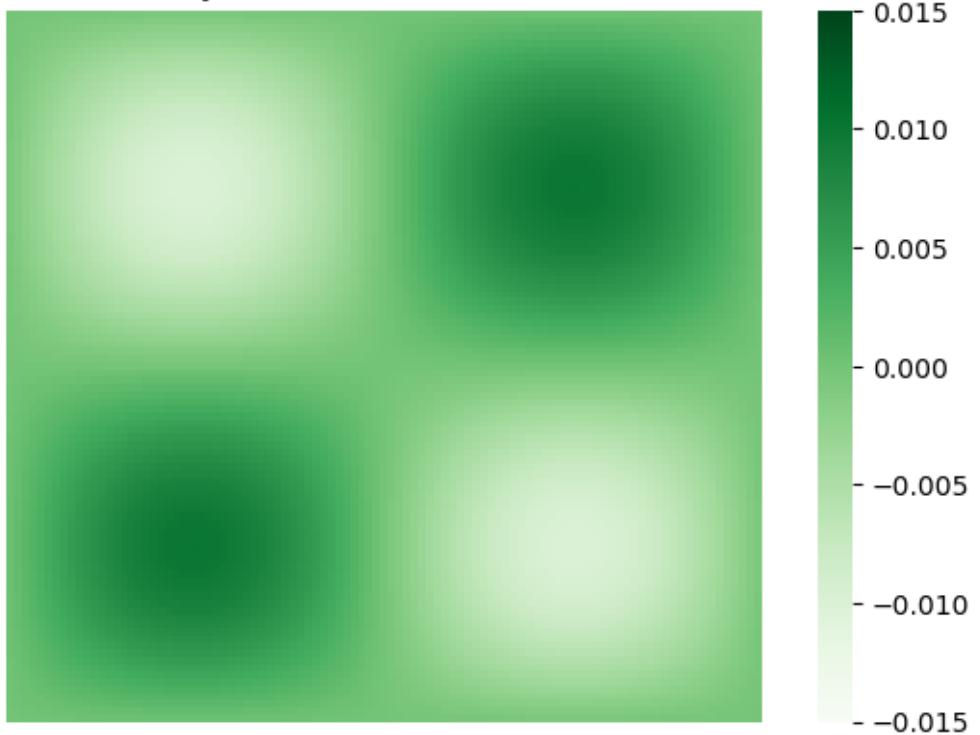
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Analytical Solution: Time = 0.655



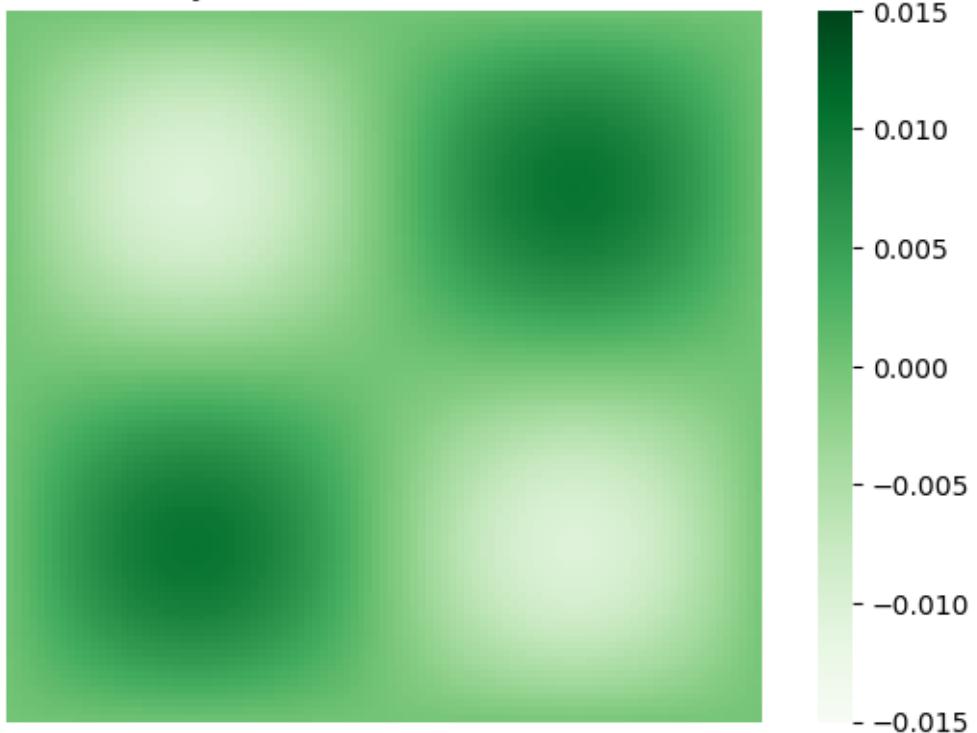
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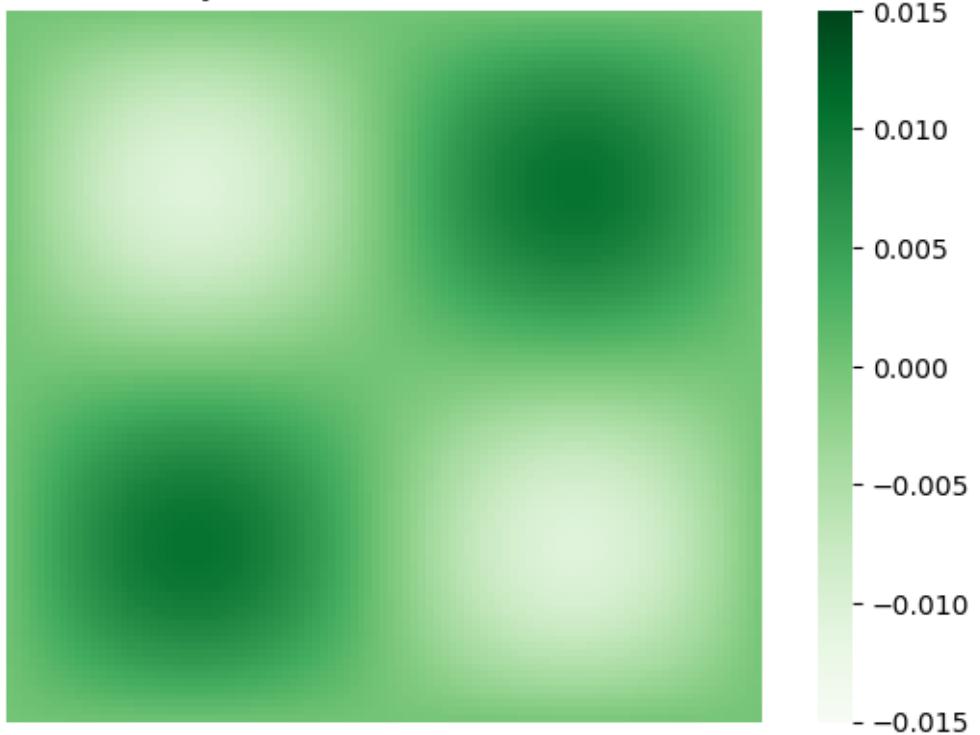
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Analytical Solution: Time = 0.665



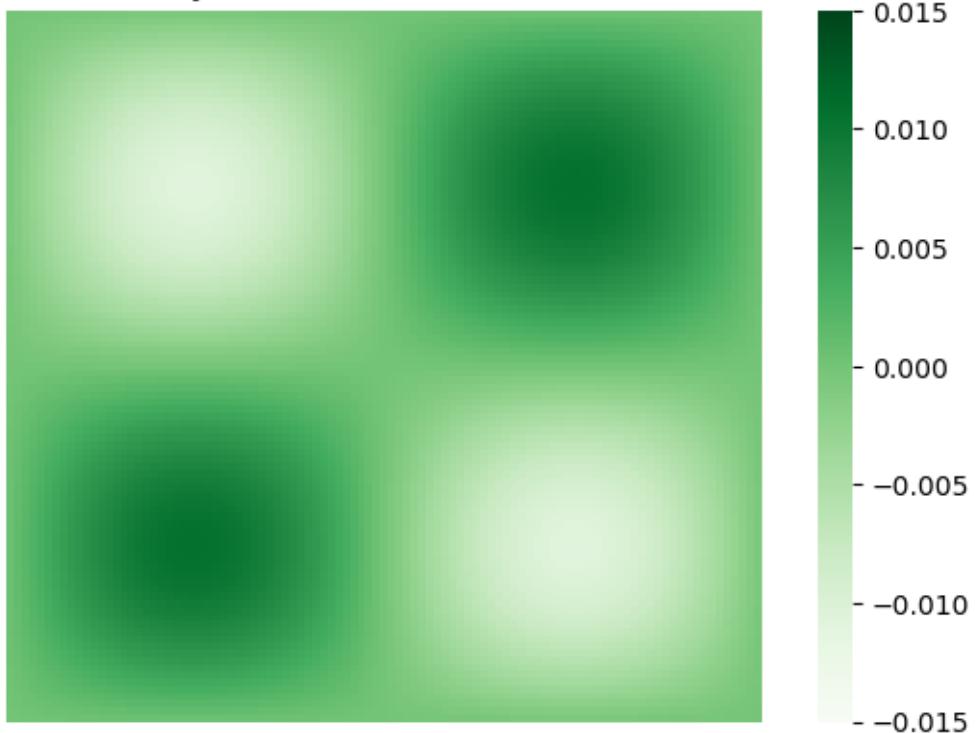
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Analytical Solution: Time = 0.67



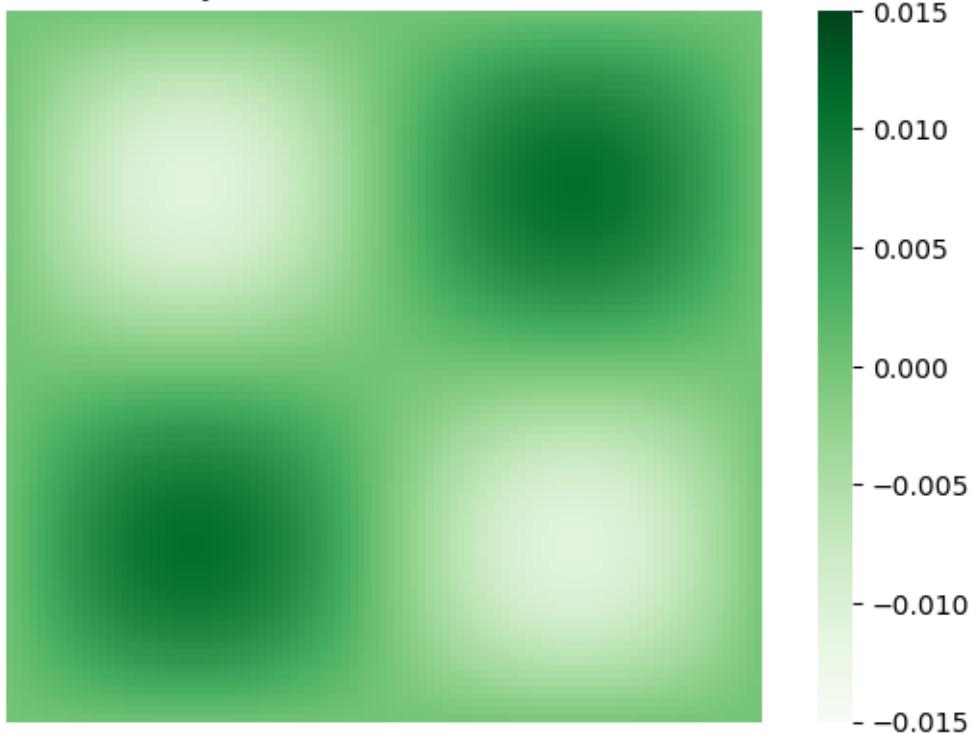
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Analytical Solution: Time = 0.675



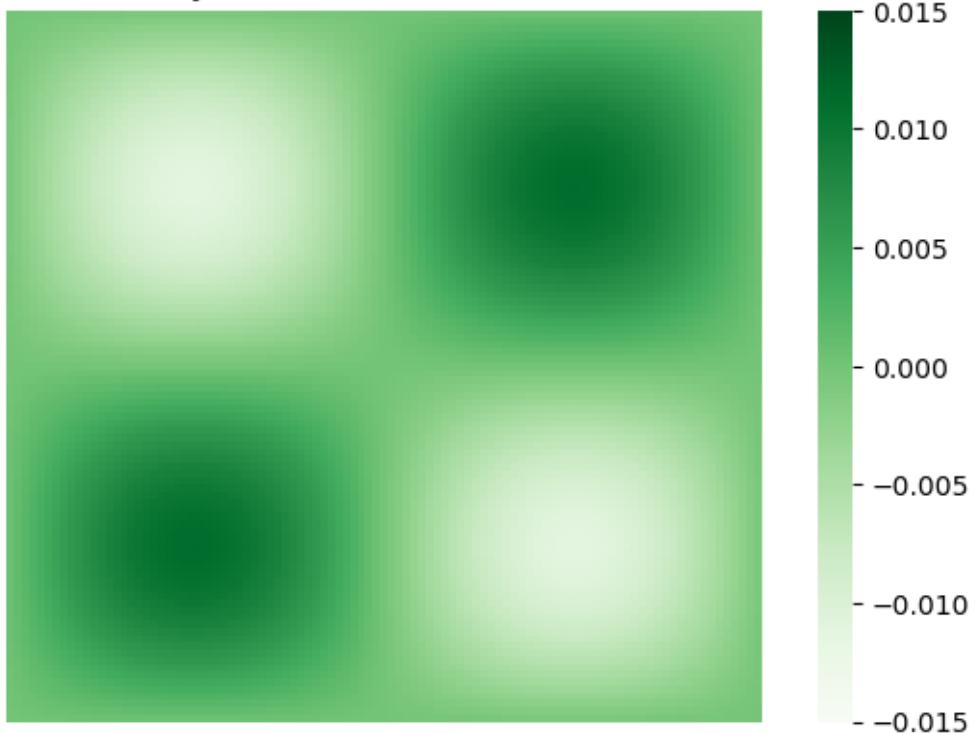
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Analytical Solution: Time = 0.68



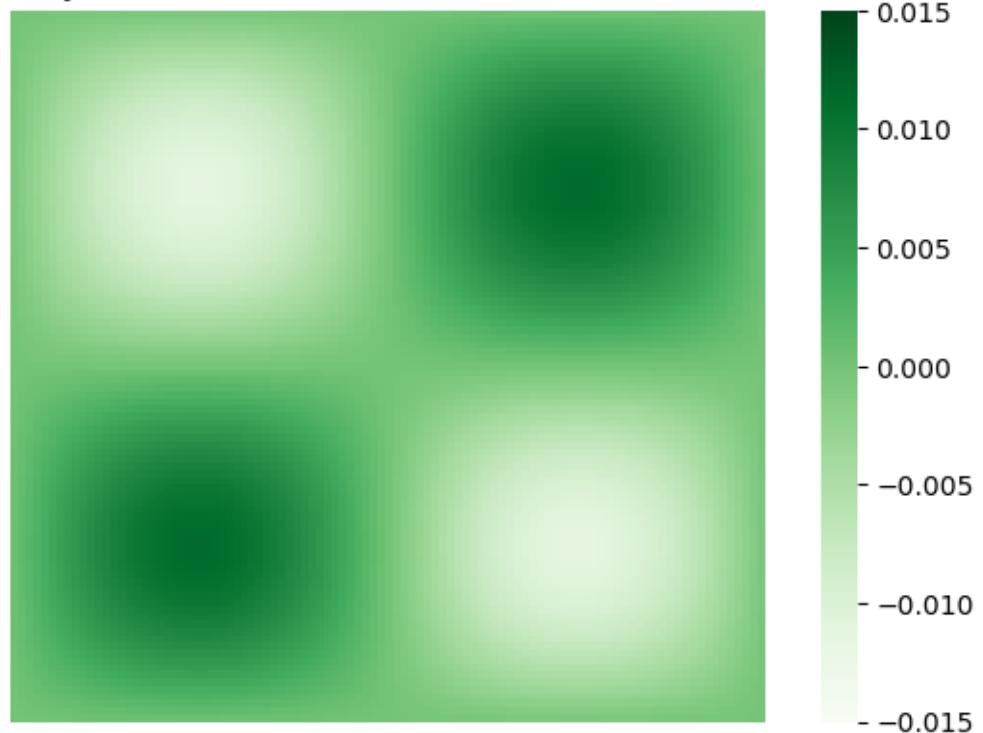
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Analytical Solution: Time = 0.685



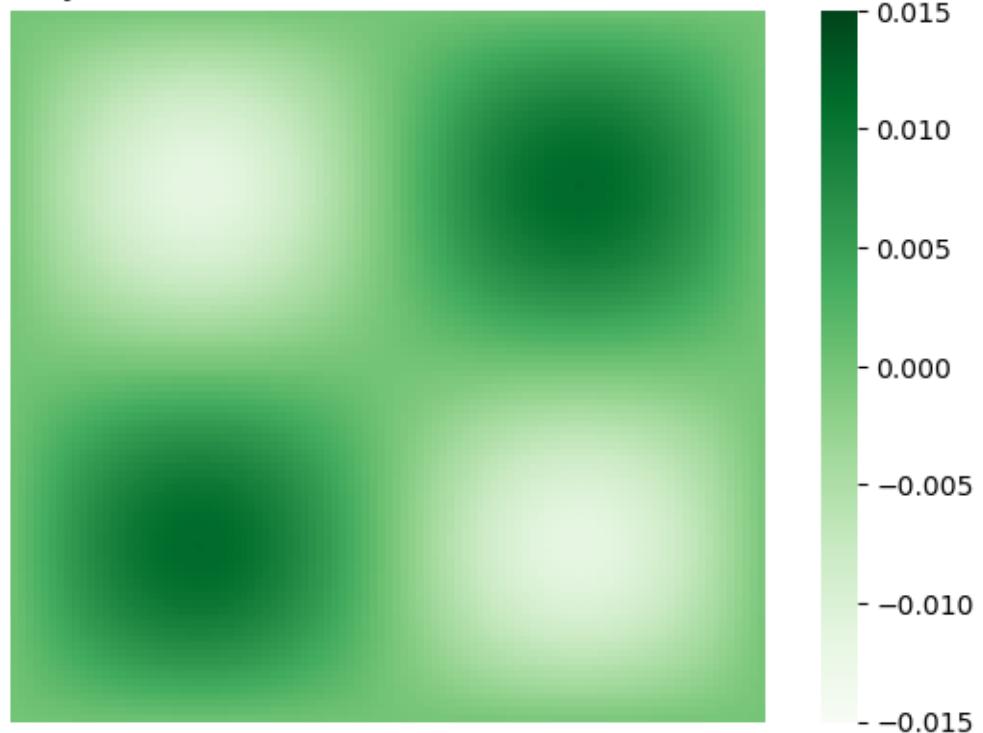
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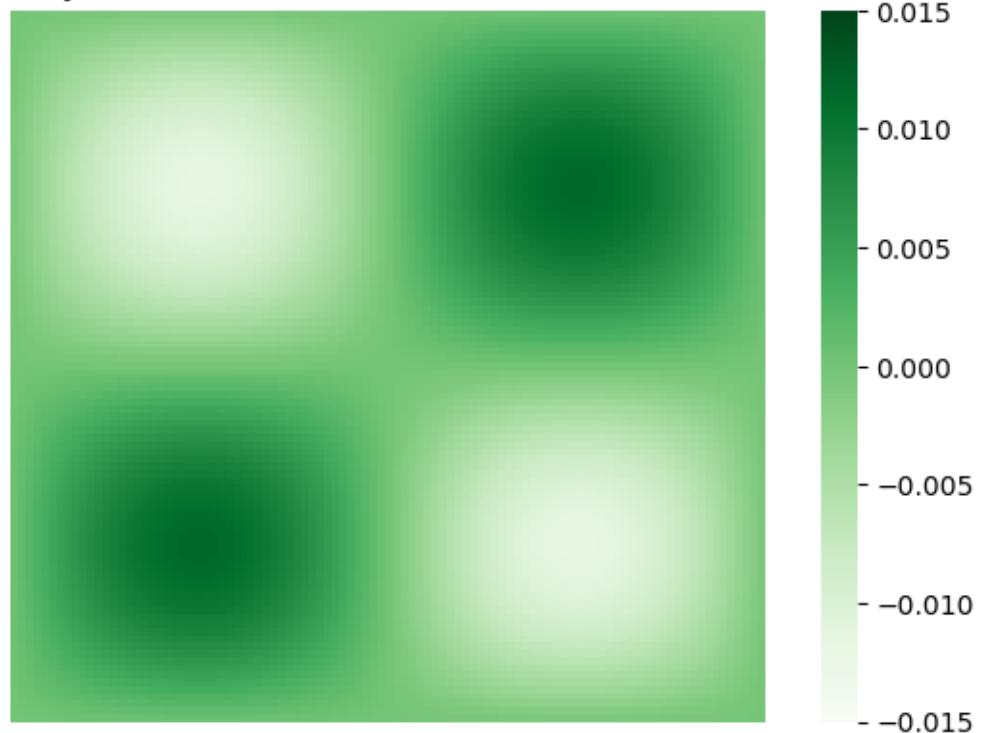
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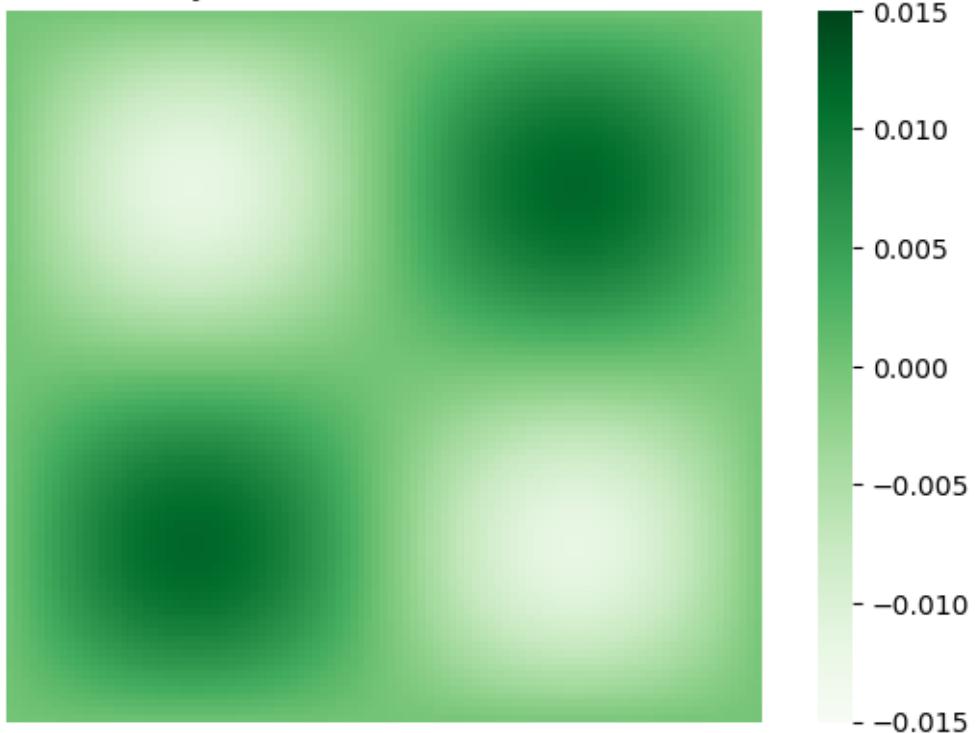
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Analytical Solution: Time = 0.7000000000000001



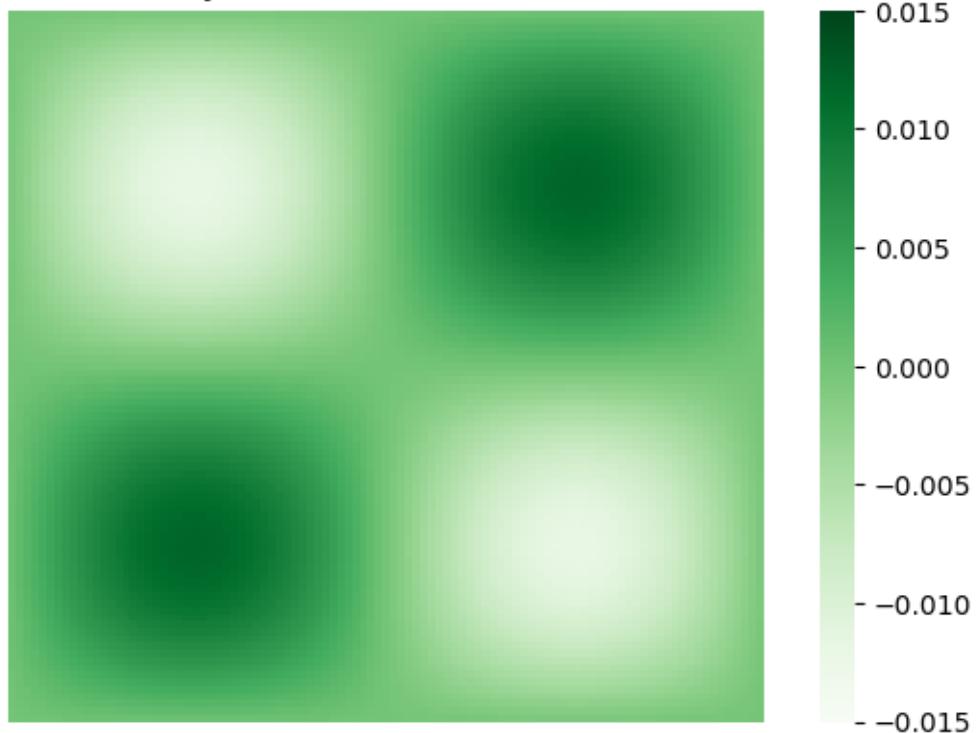
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Analytical Solution: Time = 0.705



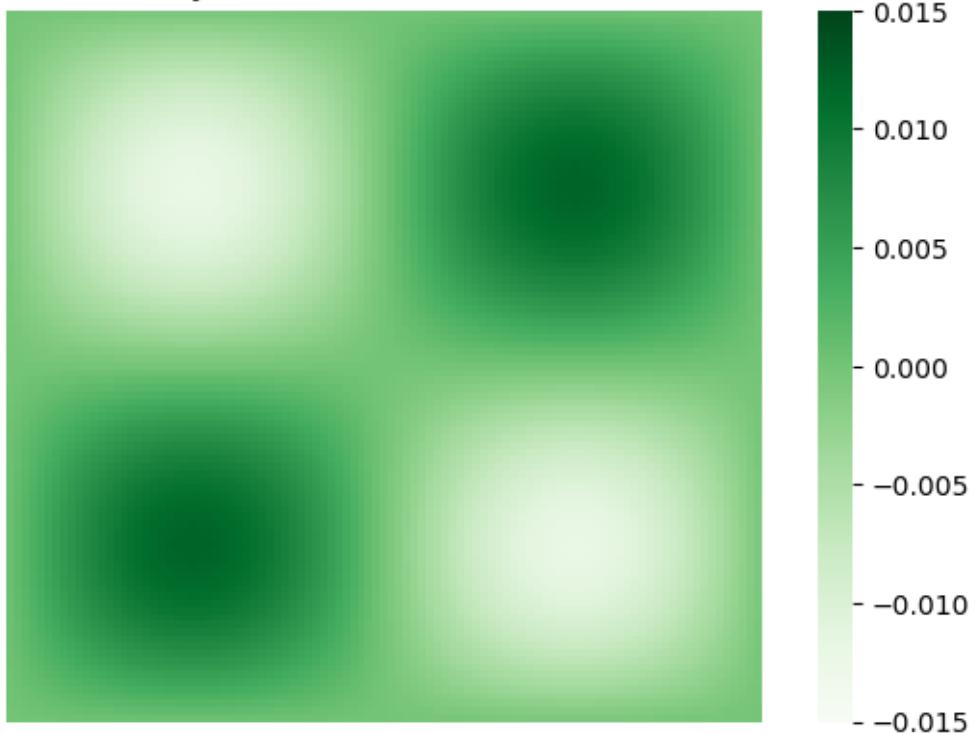
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Analytical Solution: Time = 0.71



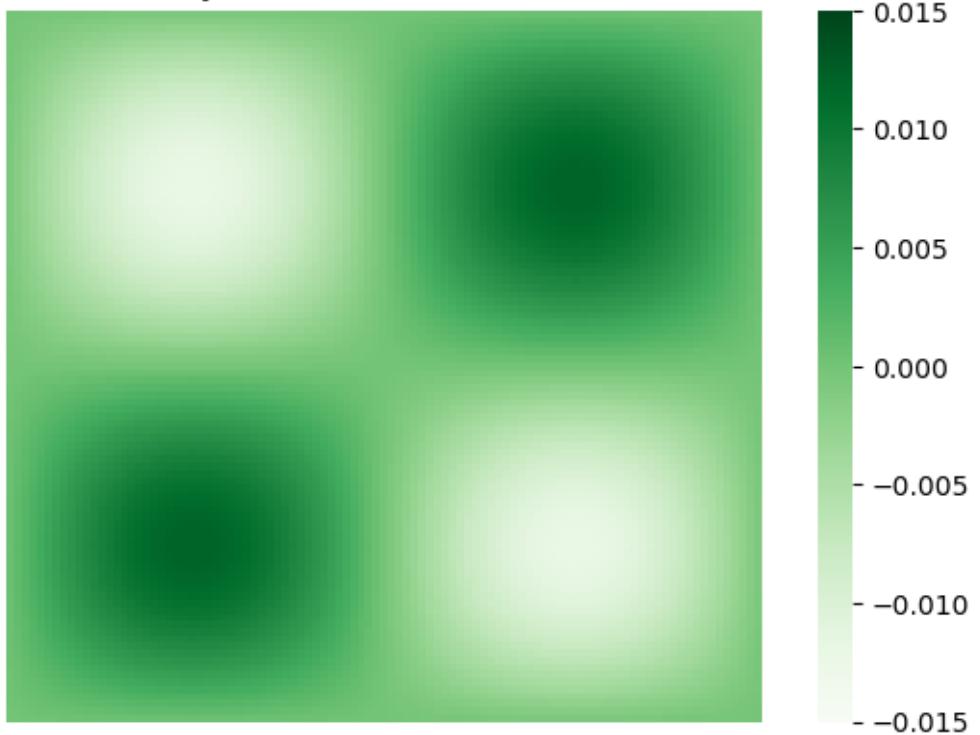
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Analytical Solution: Time = 0.715



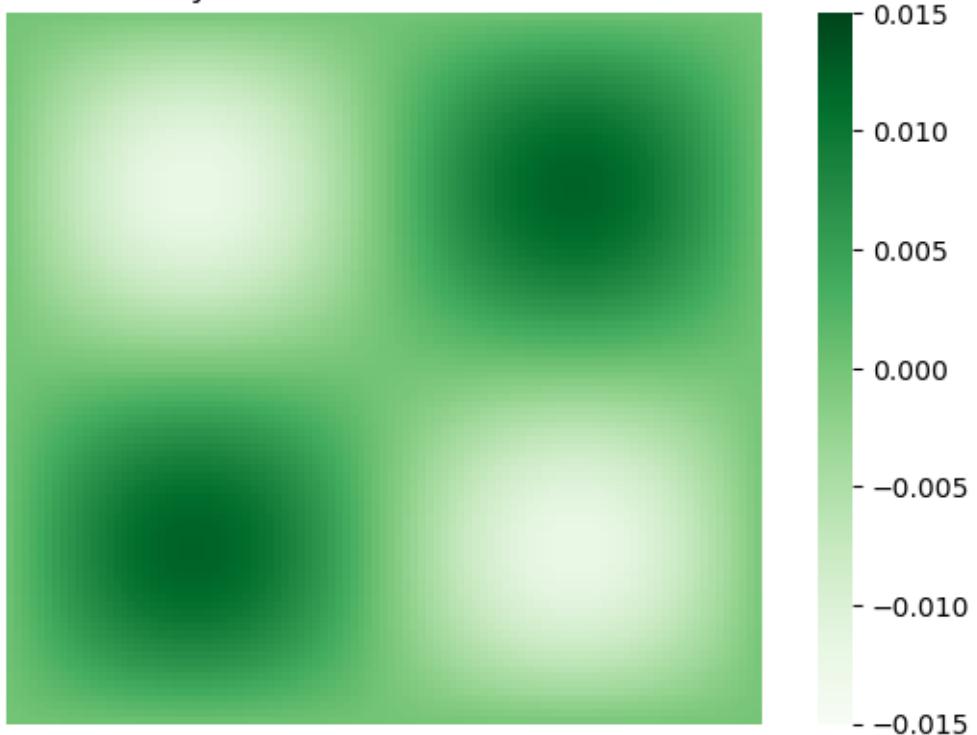
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Analytical Solution: Time = 0.72



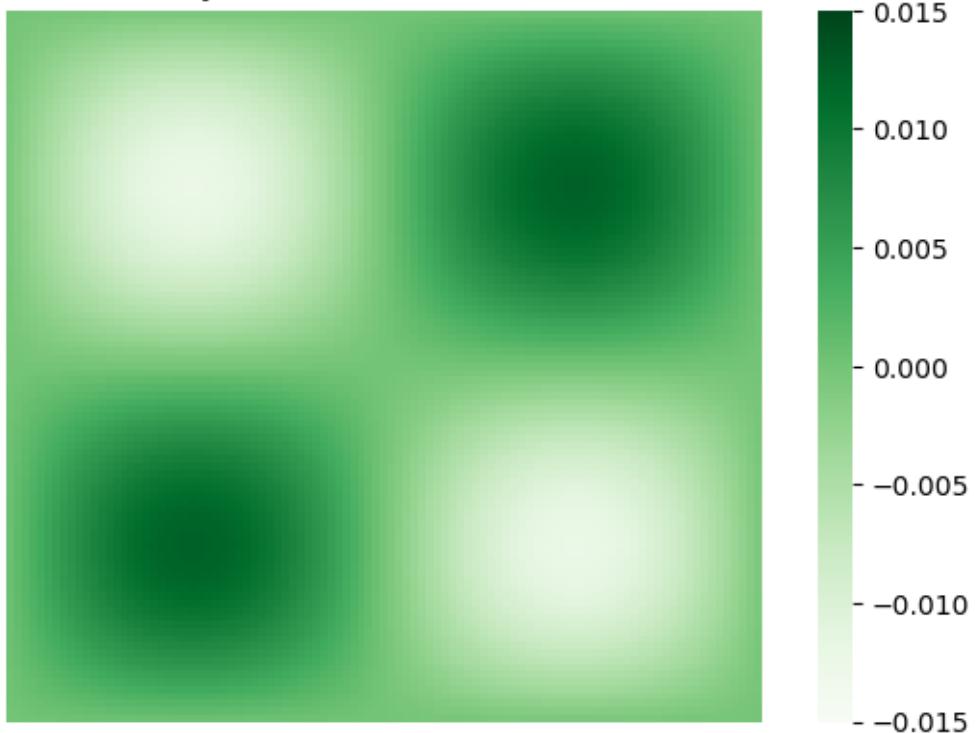
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Analytical Solution: Time = 0.725



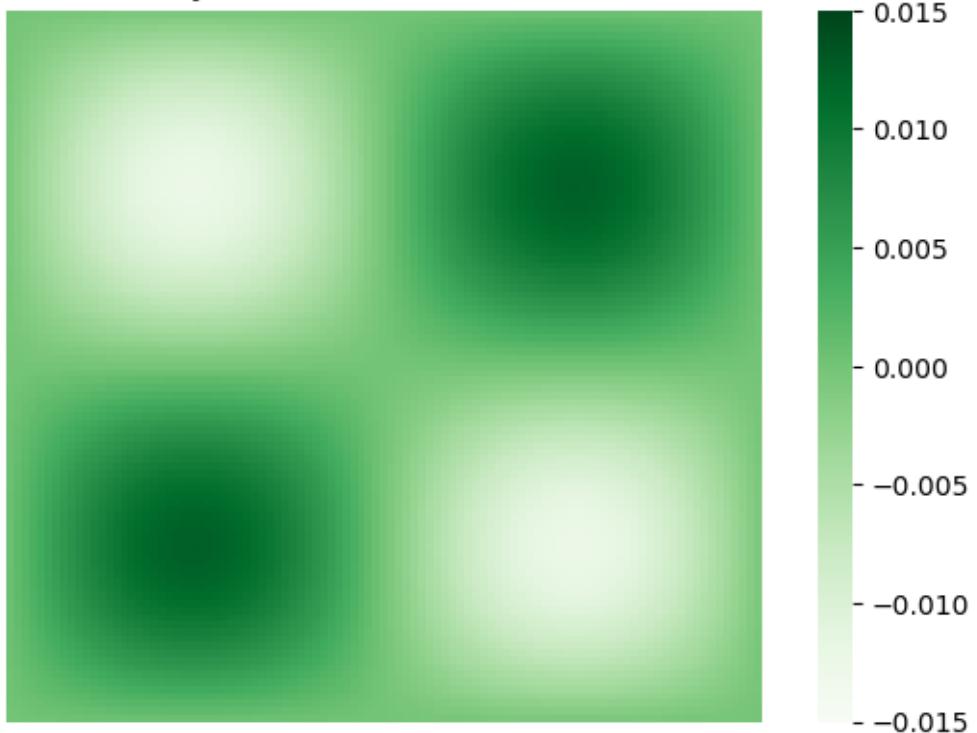
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Analytical Solution: Time = 0.73



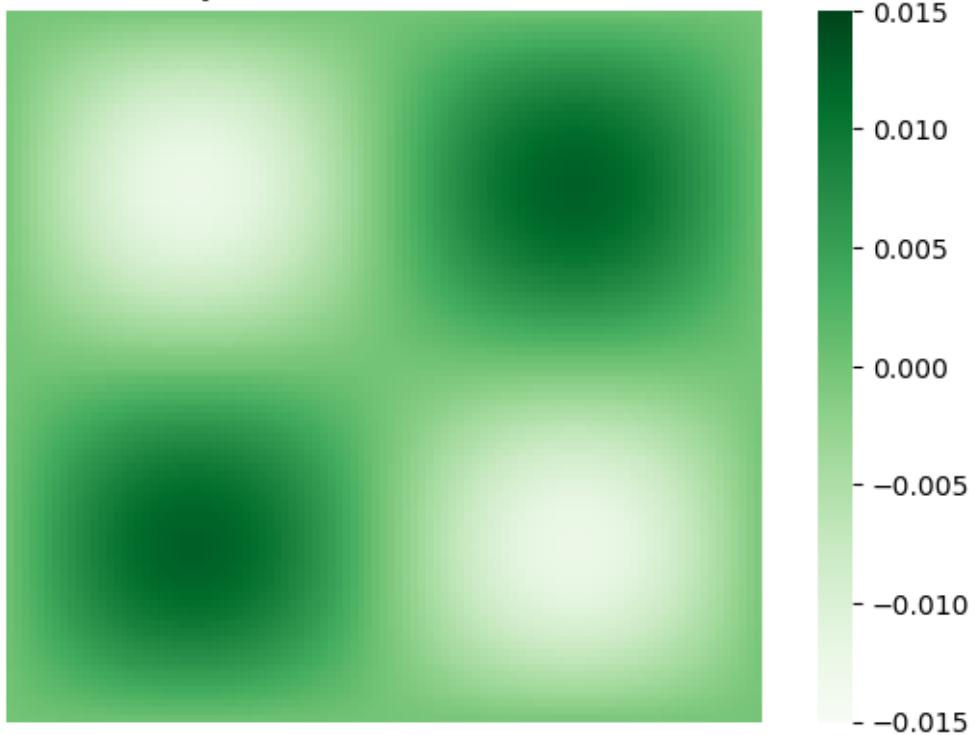
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Analytical Solution: Time = 0.735



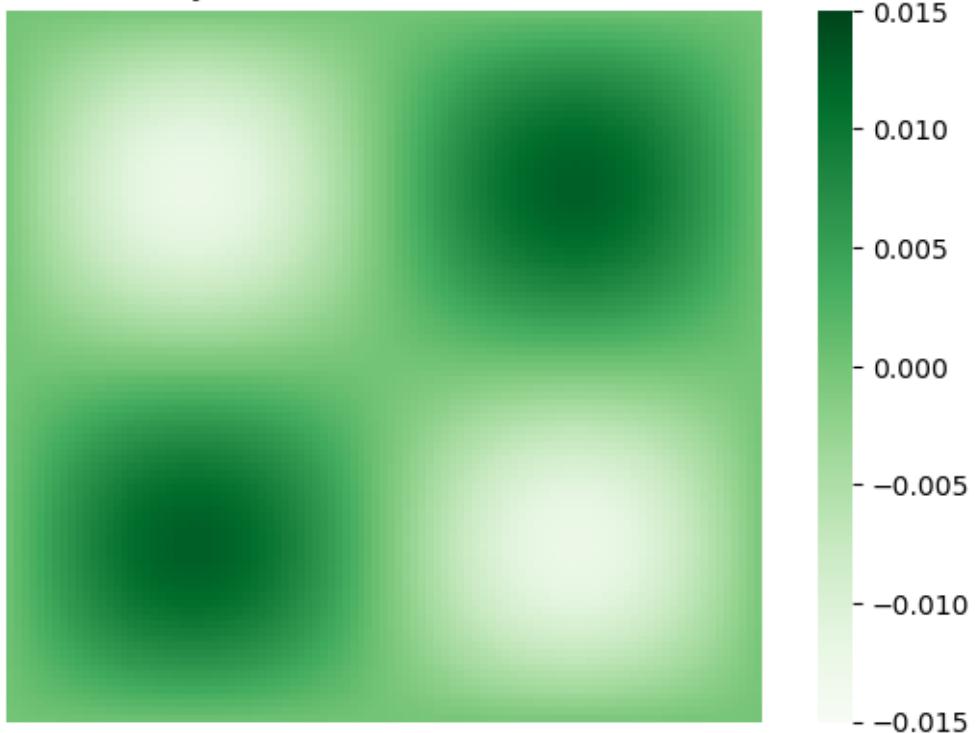
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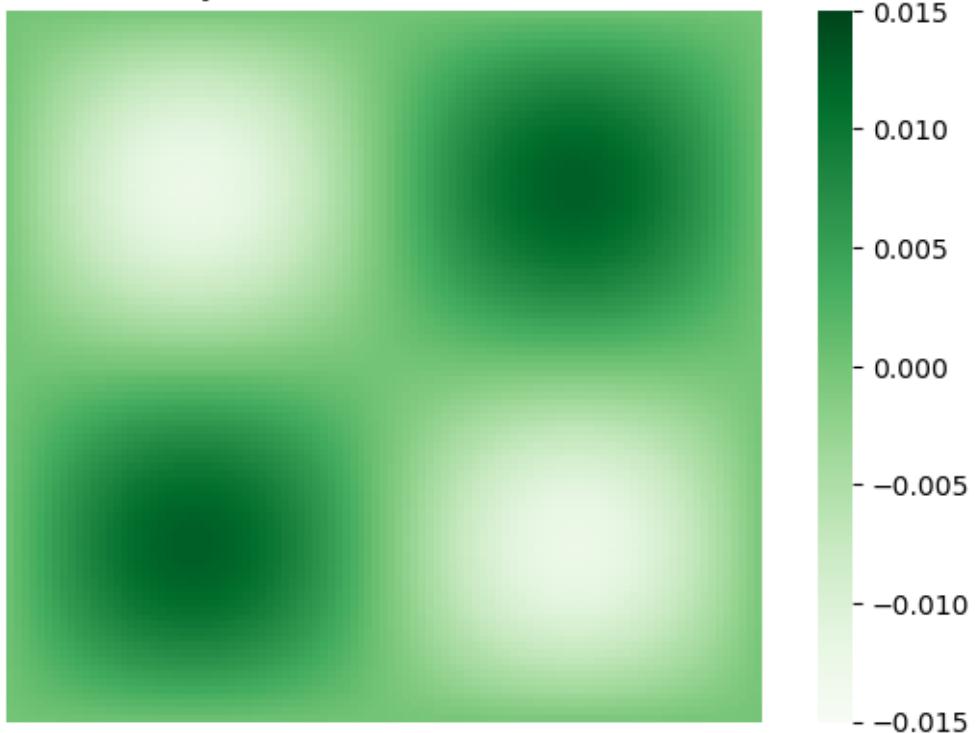
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Analytical Solution: Time = 0.745



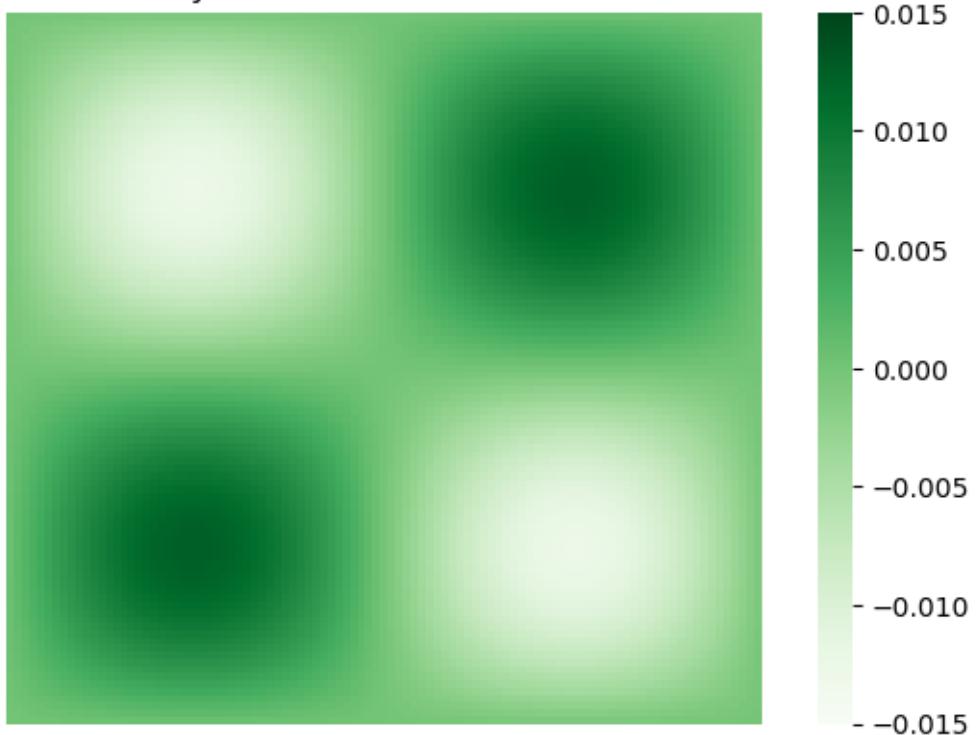
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Analytical Solution: Time = 0.75



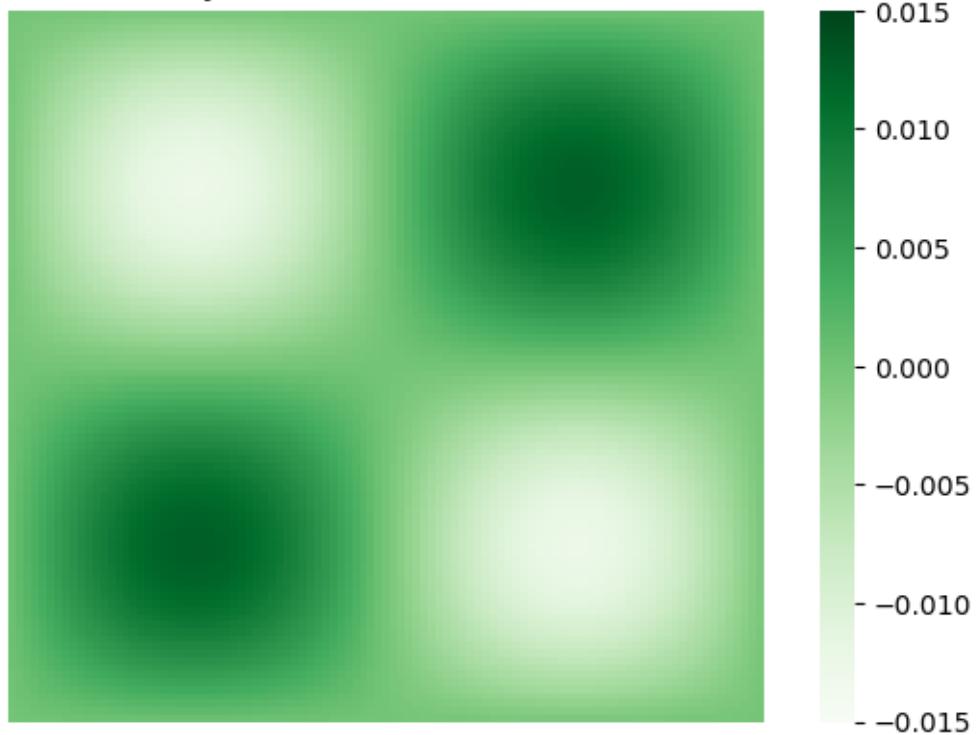
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Analytical Solution: Time = 0.755



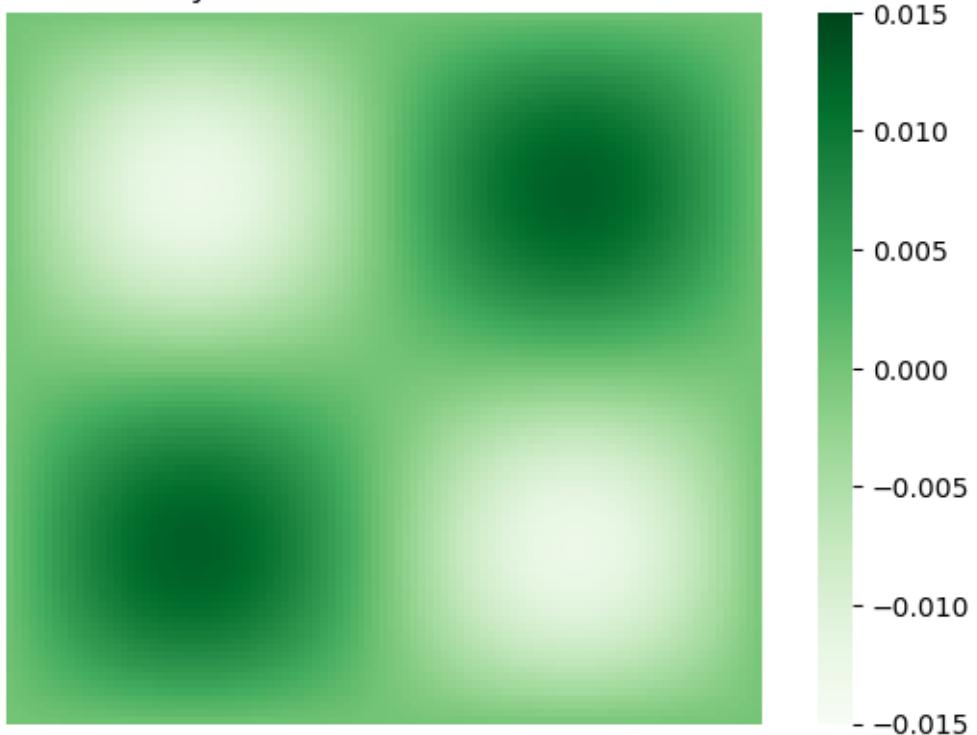
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Analytical Solution: Time = 0.76



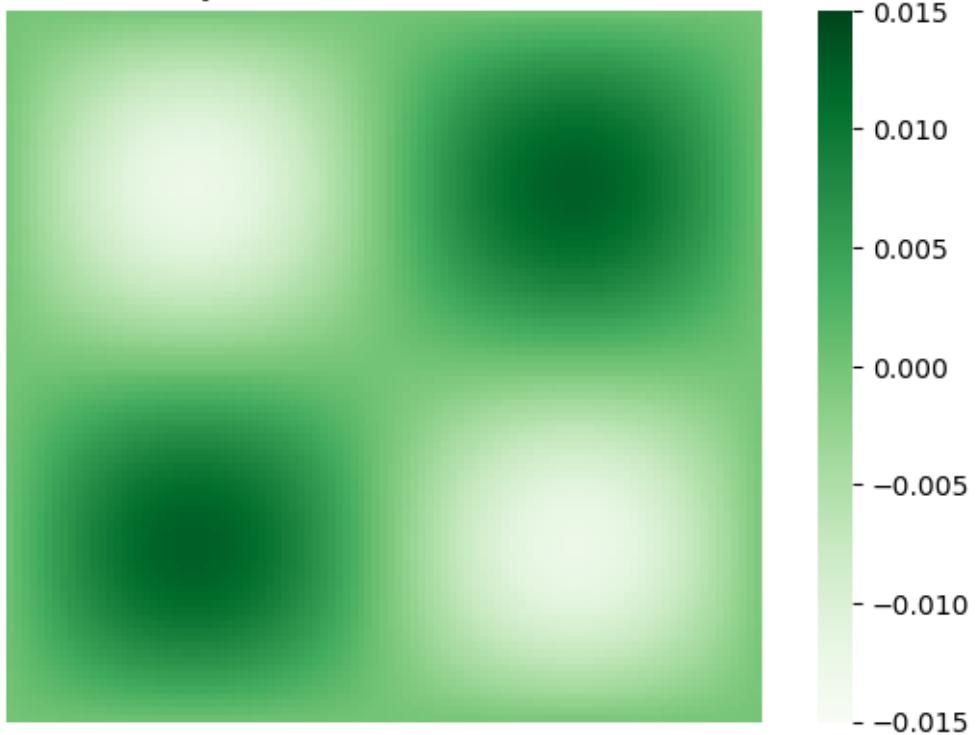
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Analytical Solution: Time = 0.765



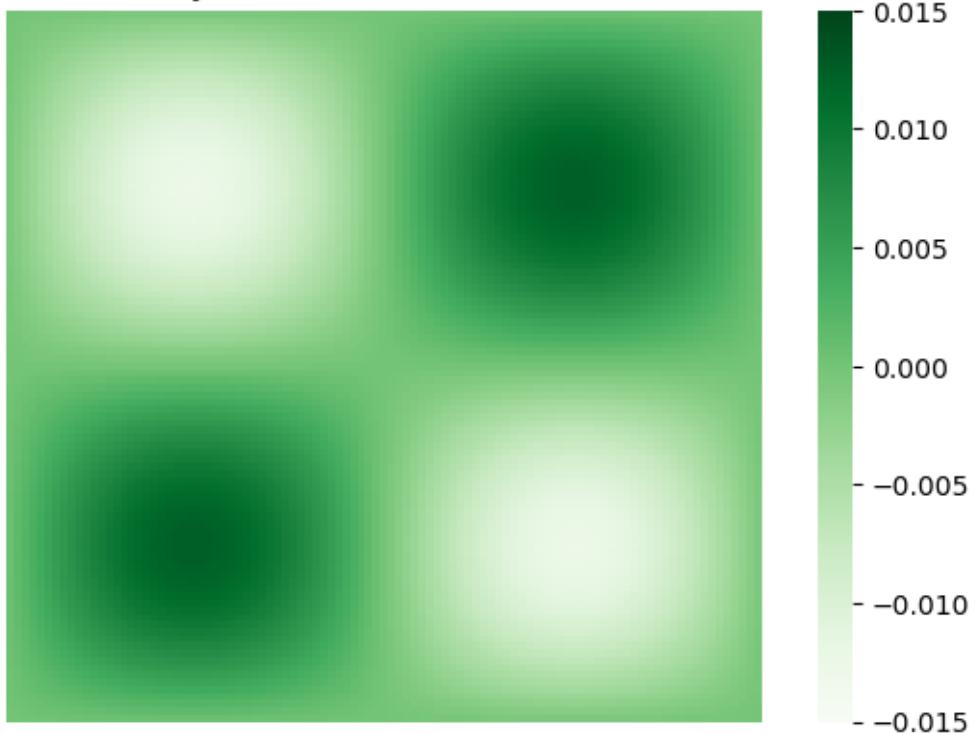
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Analytical Solution: Time = 0.77



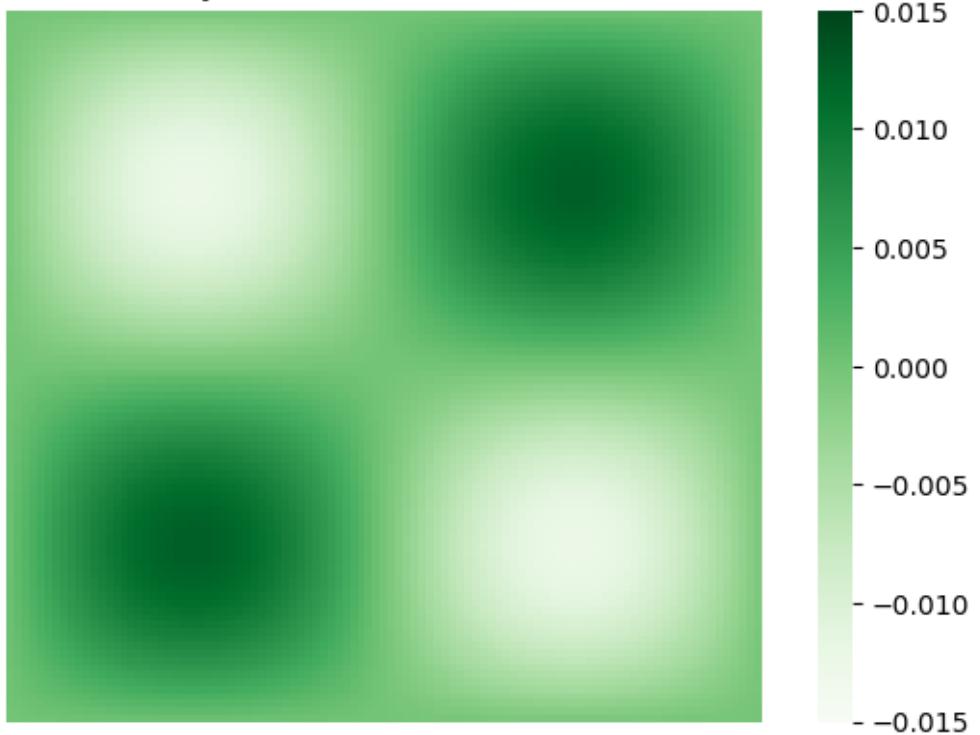
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Analytical Solution: Time = 0.775



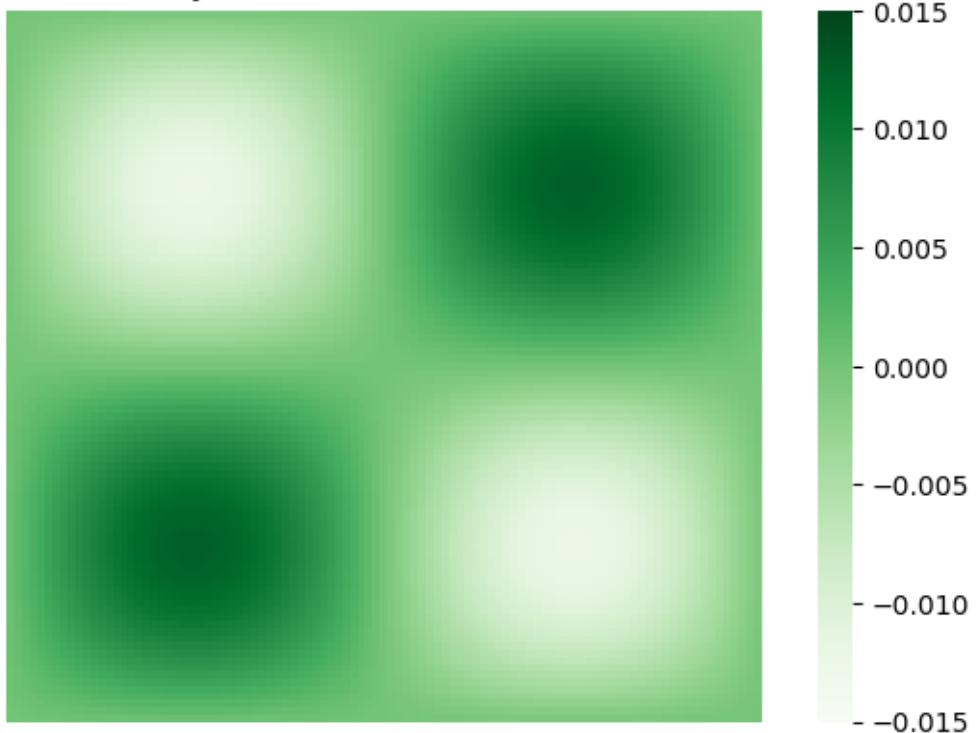
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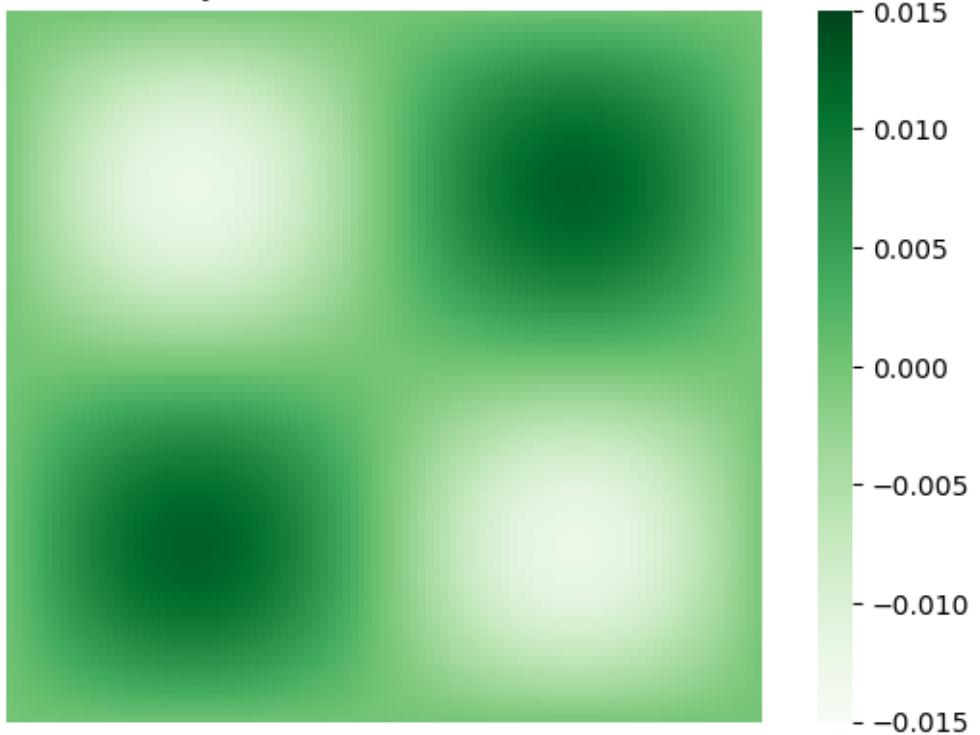
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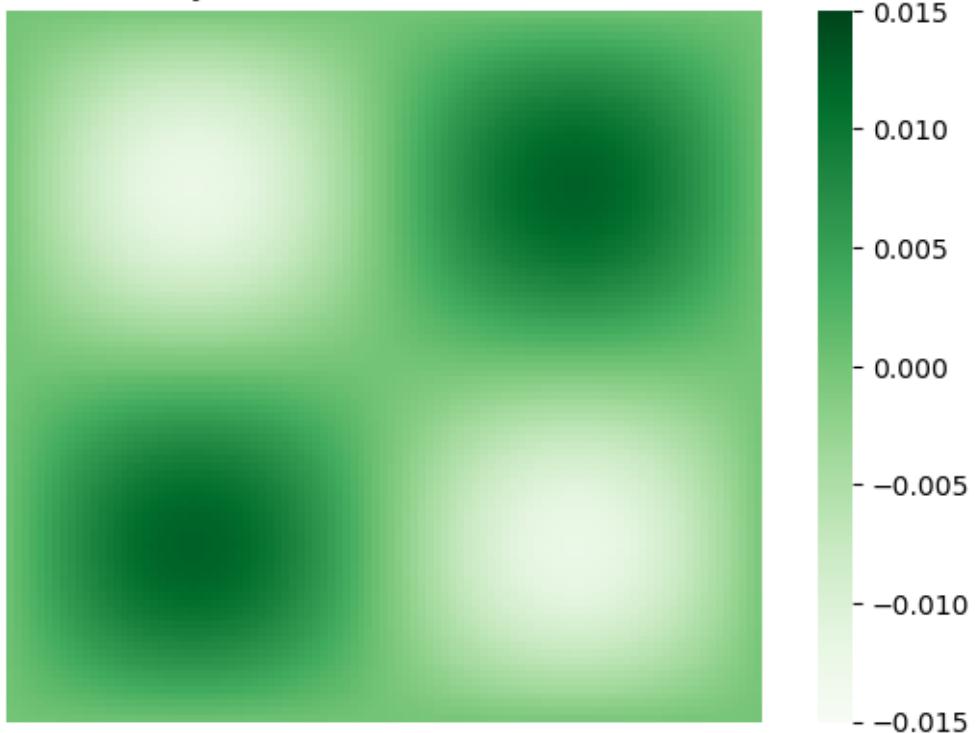
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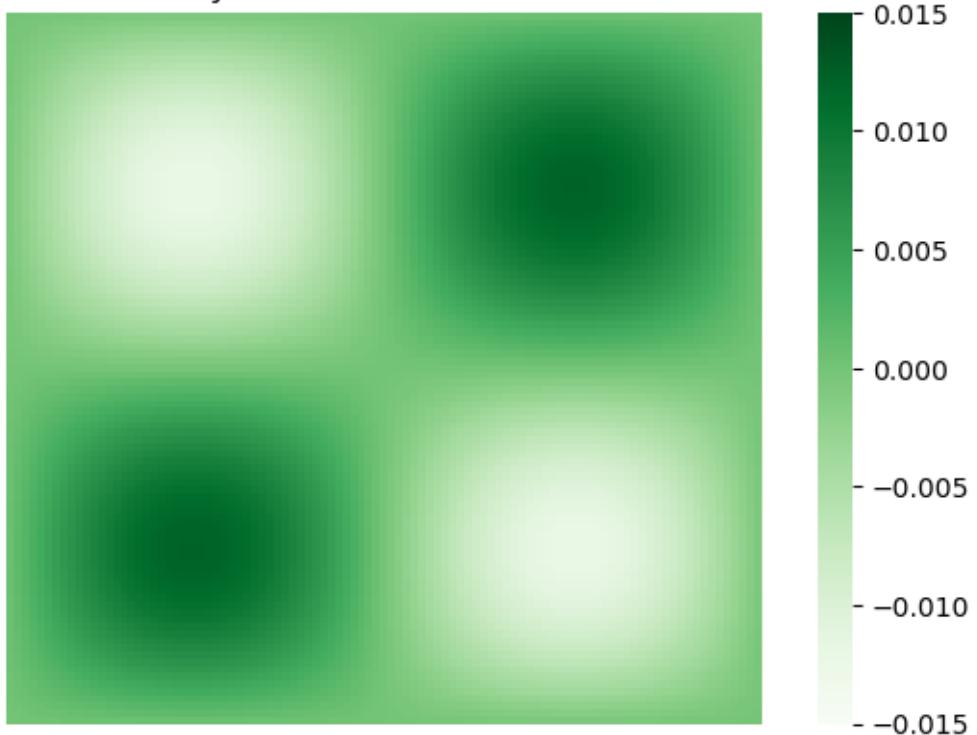
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Analytical Solution: Time = 0.795



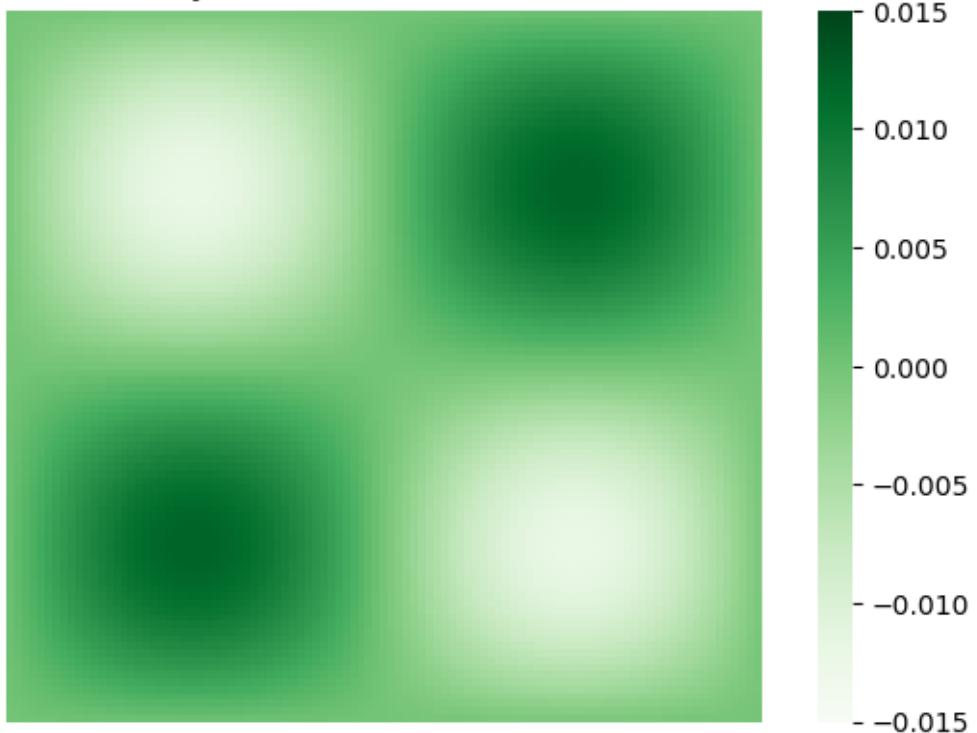
Q_4_Analytical_Solution_at_time_0.800000_.csv

Analytical Solution: Time = 0.8



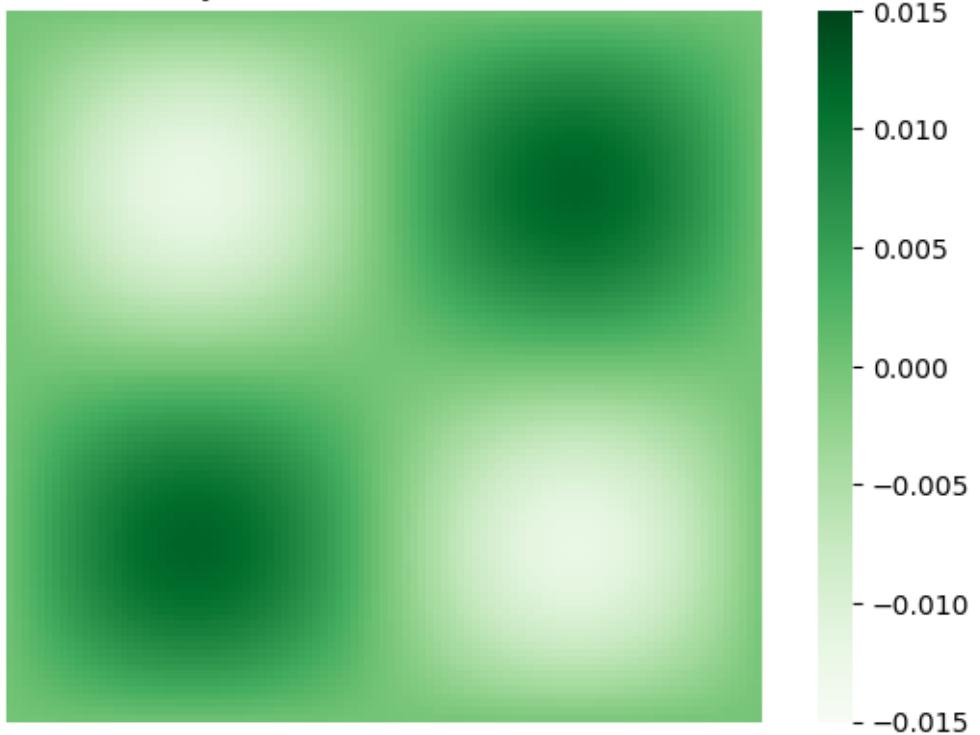
Q_4_Analytical_Solution_at_time_0.805000_.csv

Analytical Solution: Time = 0.805



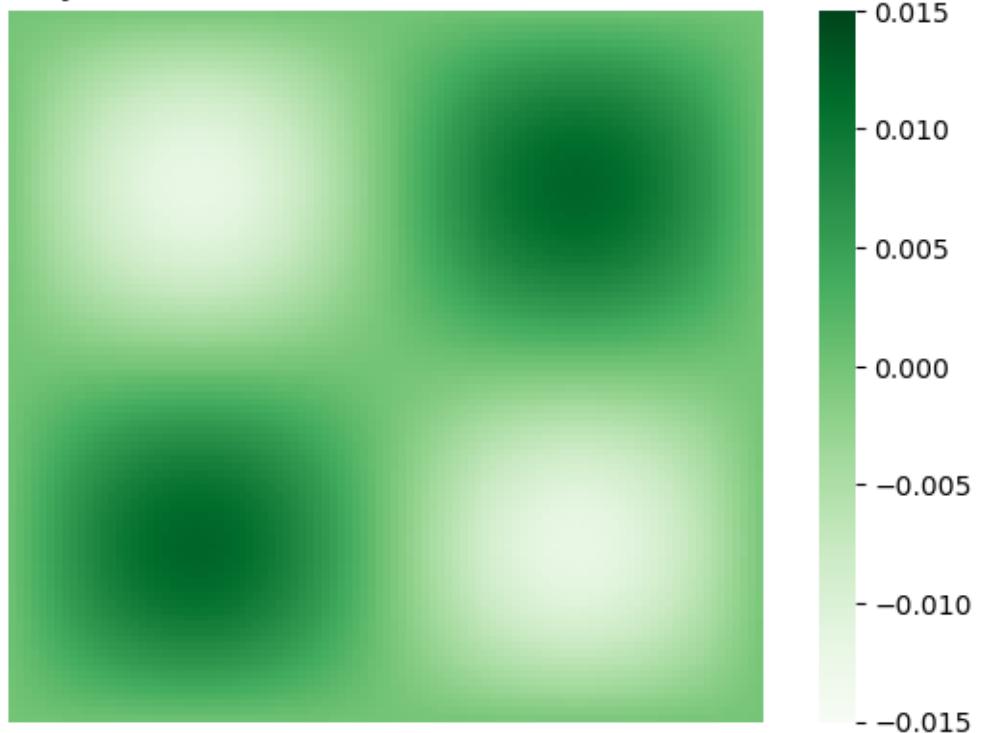
Q_4_Analytical_Solution_at_time_0.810000_.csv

Analytical Solution: Time = 0.81



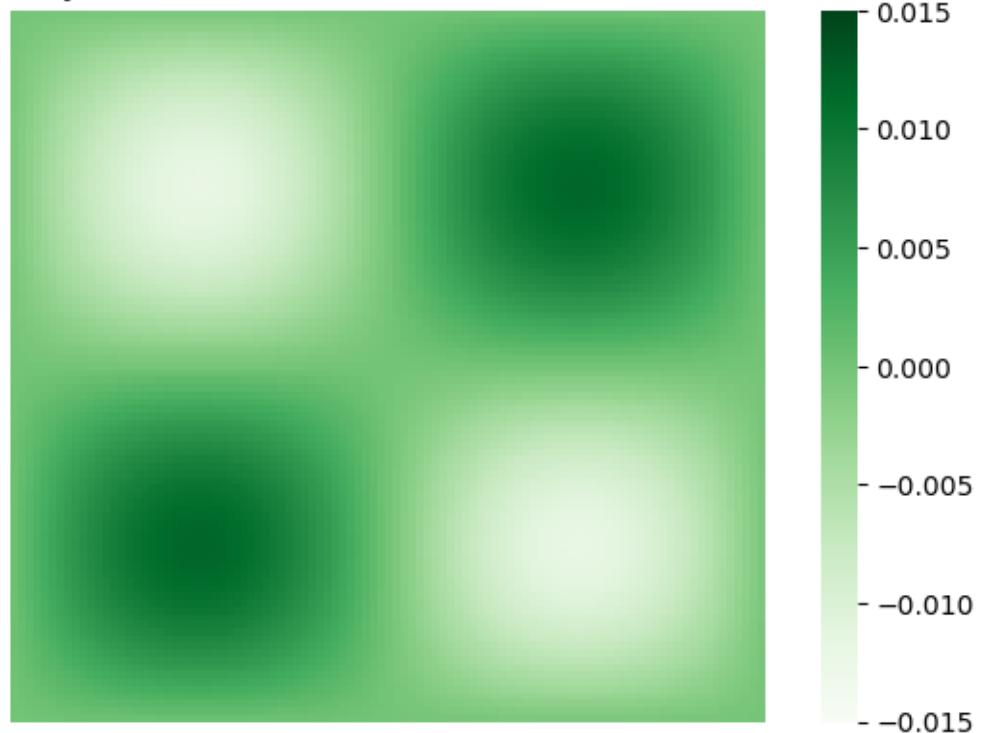
Q_4_Analytical_Solution_at_time_0.815000_.csv

Analytical Solution: Time = 0.8150000000000001



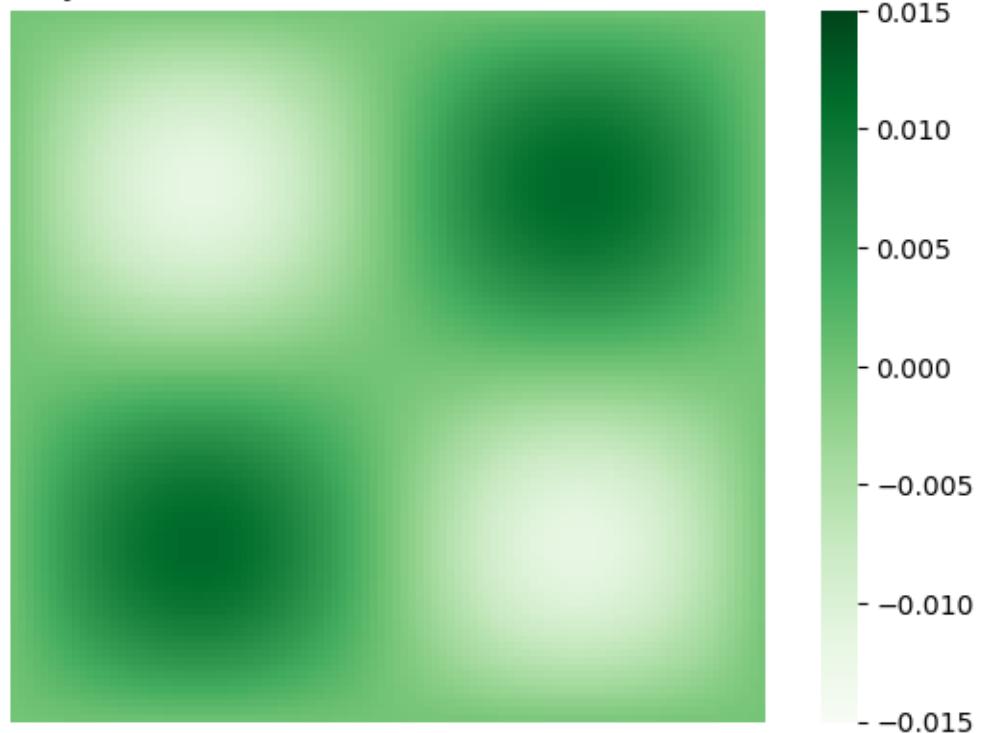
Q_4_Analytical_Solution_at_time_0.820000_.csv

Analytical Solution: Time = 0.8200000000000001



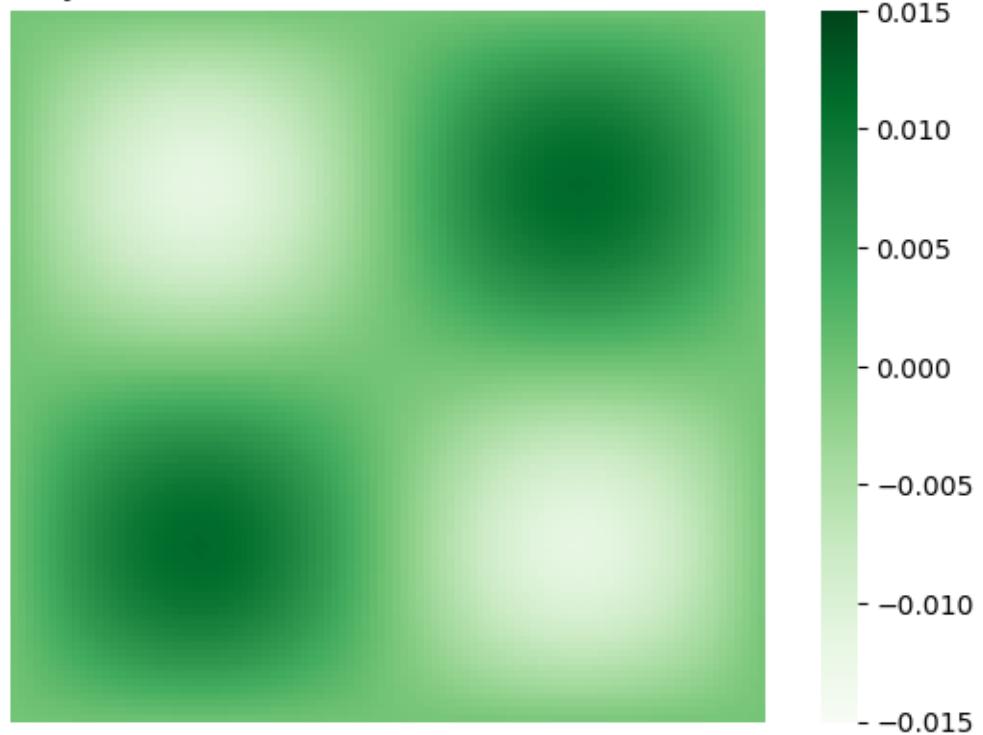
Q_4_Analytical_Solution_at_time_0.825000_.csv

Analytical Solution: Time = 0.8250000000000001



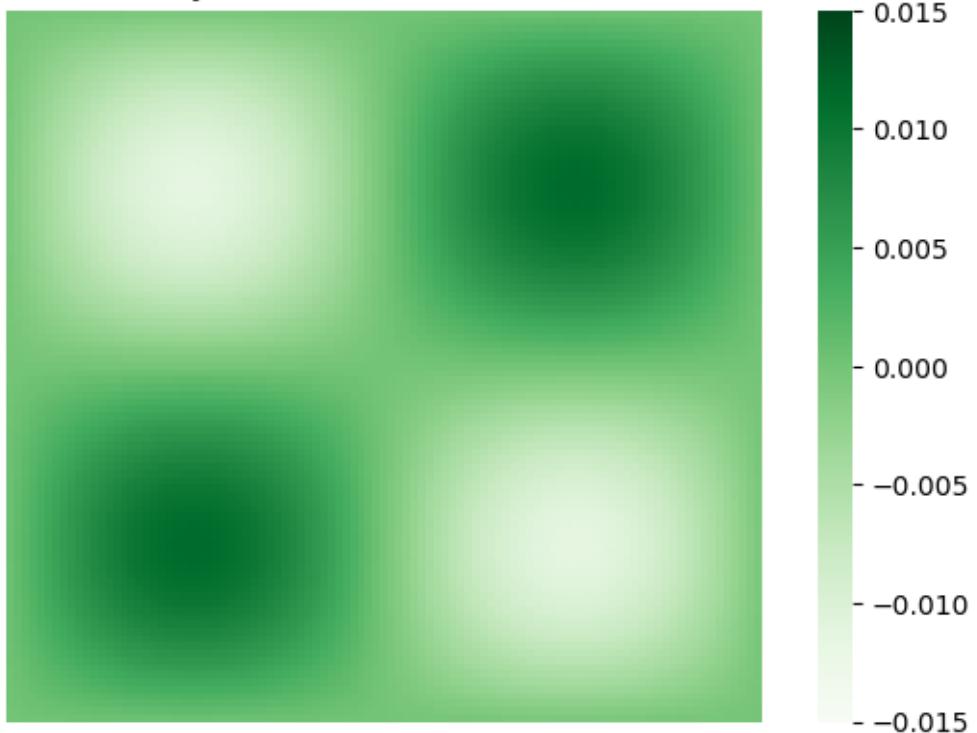
Q_4_Analytical_Solution_at_time_0.830000_.csv

Analytical Solution: Time = 0.8300000000000001



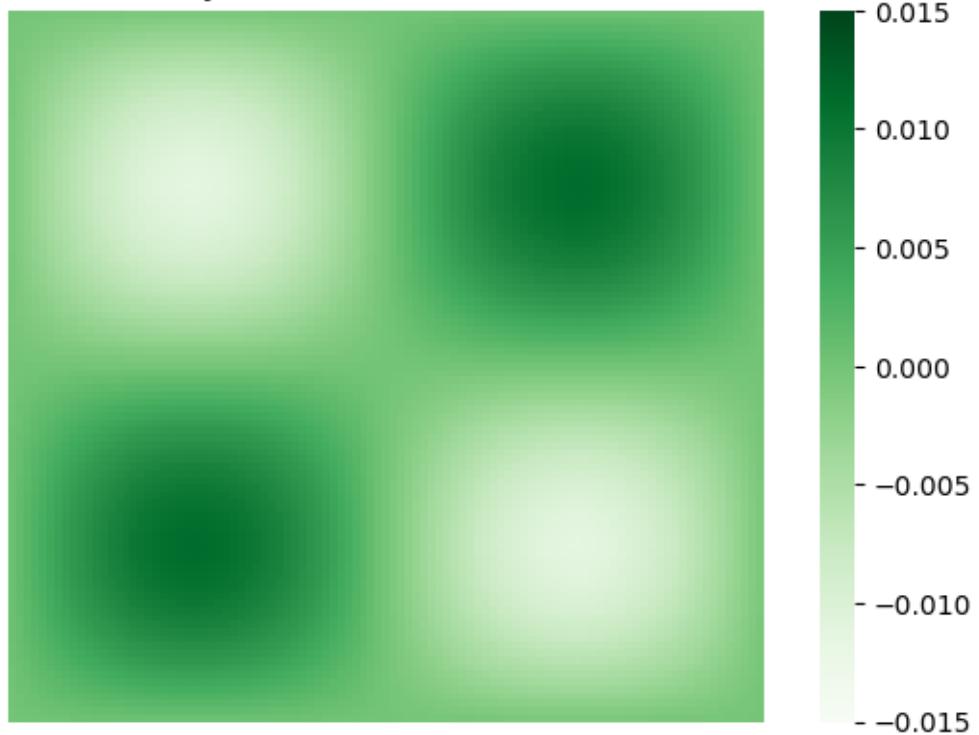
Q_4_Analytical_Solution_at_time_0.835000_.csv

Analytical Solution: Time = 0.835



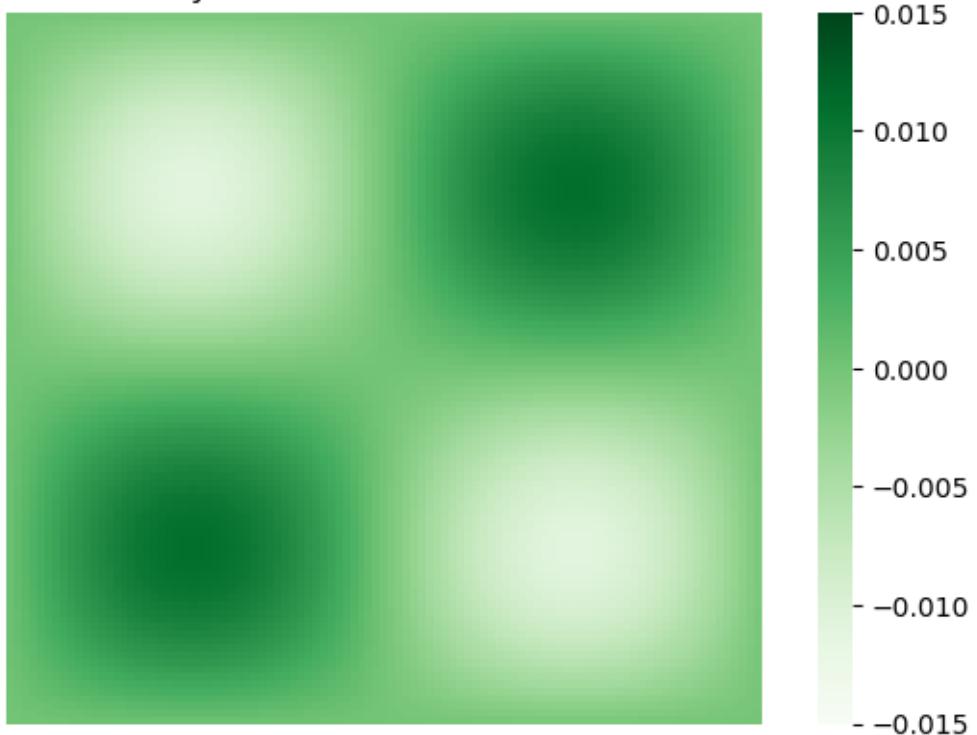
Q_4_Analytical_Solution_at_time_0.840000_.csv

Analytical Solution: Time = 0.84



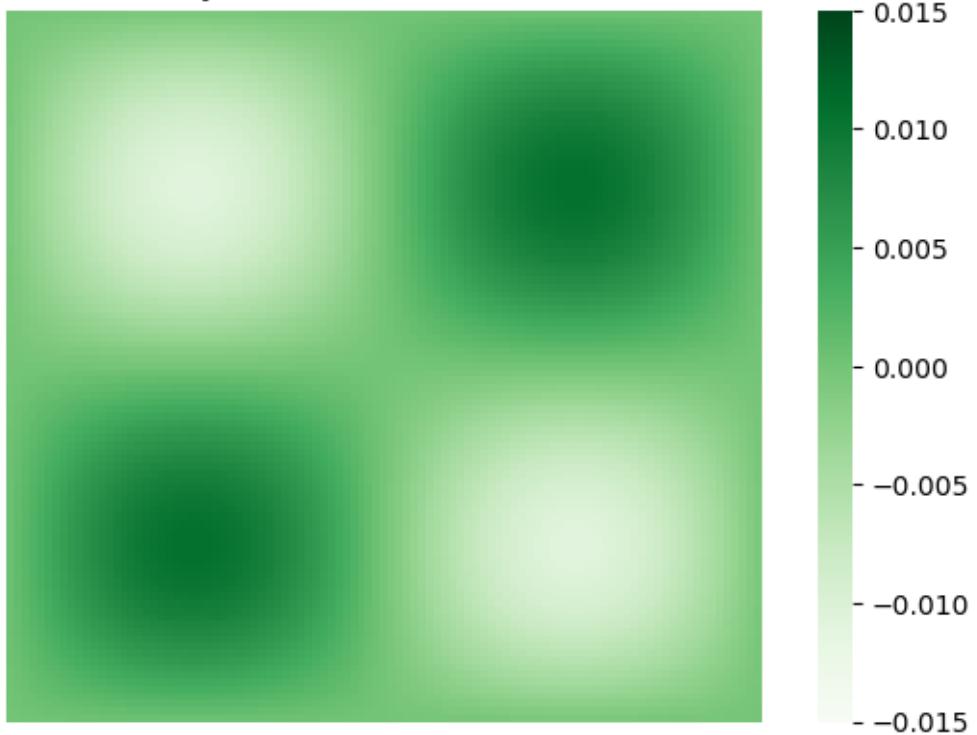
Q_4_Analytical_Solution_at_time_0.845000_.csv

Analytical Solution: Time = 0.845



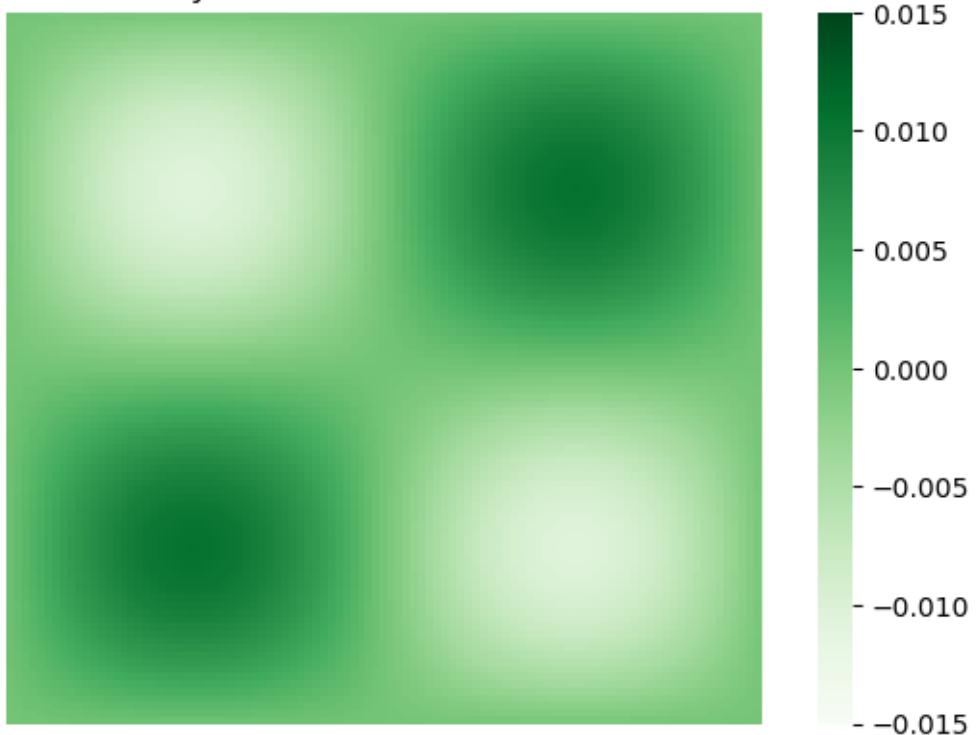
Q_4_Analytical_Solution_at_time_0.850000_.csv

Analytical Solution: Time = 0.85



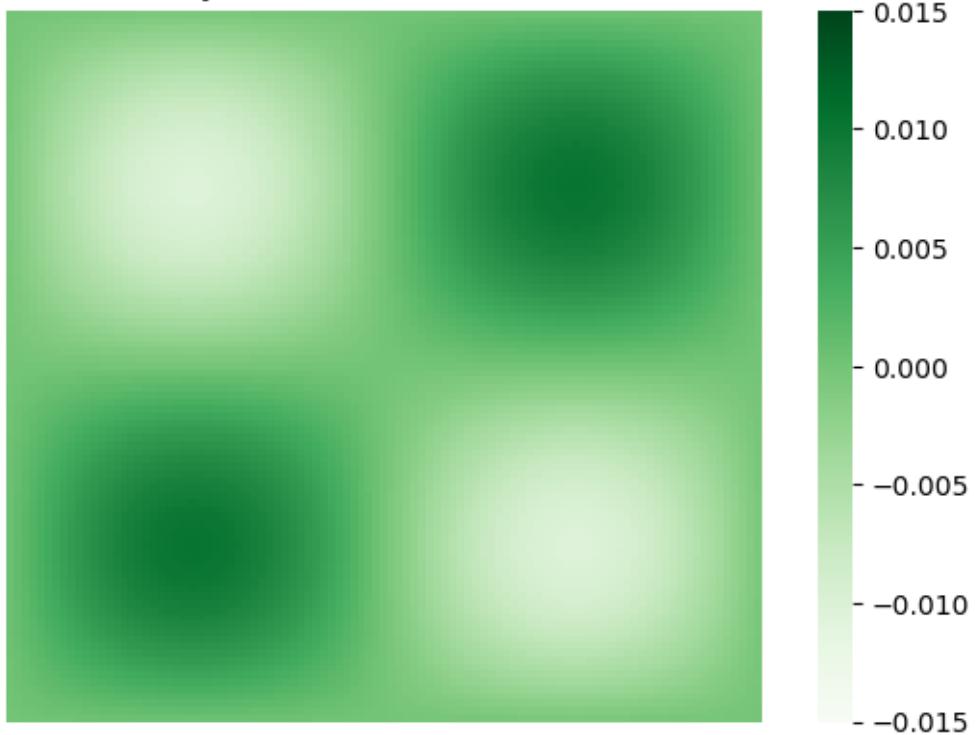
Q_4_Analytical_Solution_at_time_0.855000_.csv

Analytical Solution: Time = 0.855



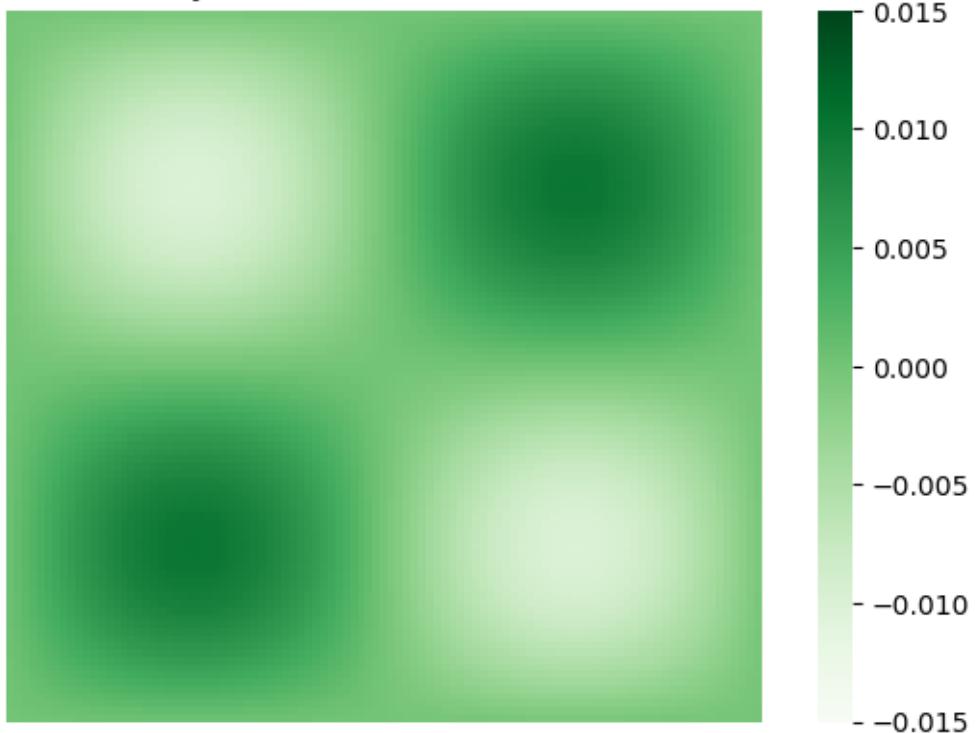
Q_4_Analytical_Solution_at_time_0.860000_.csv

Analytical Solution: Time = 0.86



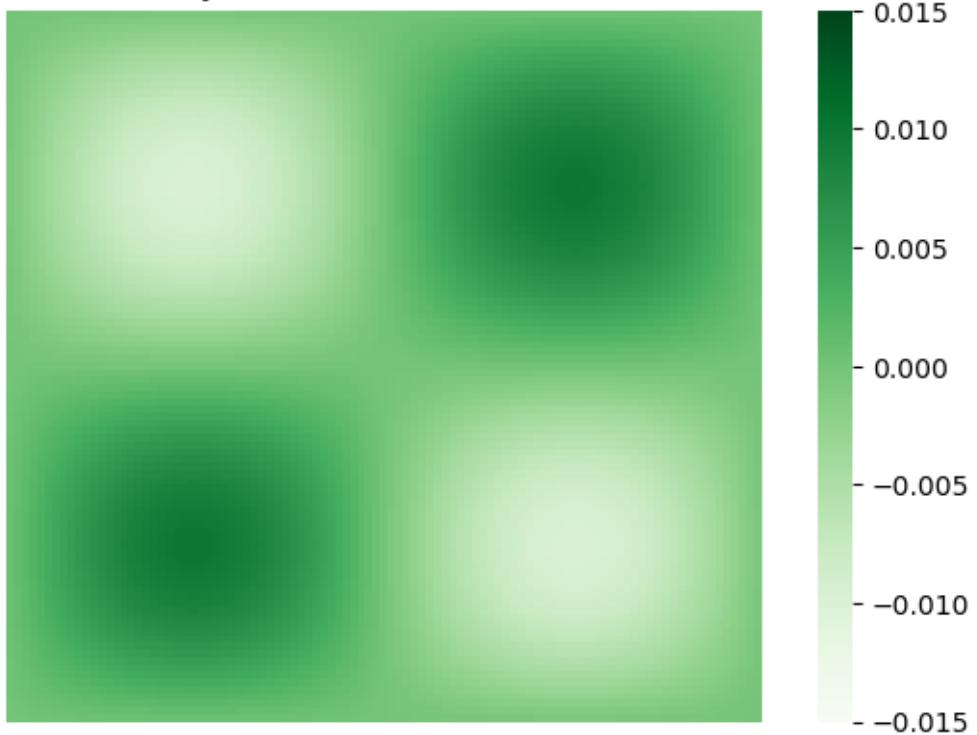
Q_4_Analytical_Solution_at_time_0.865000_.csv

Analytical Solution: Time = 0.865



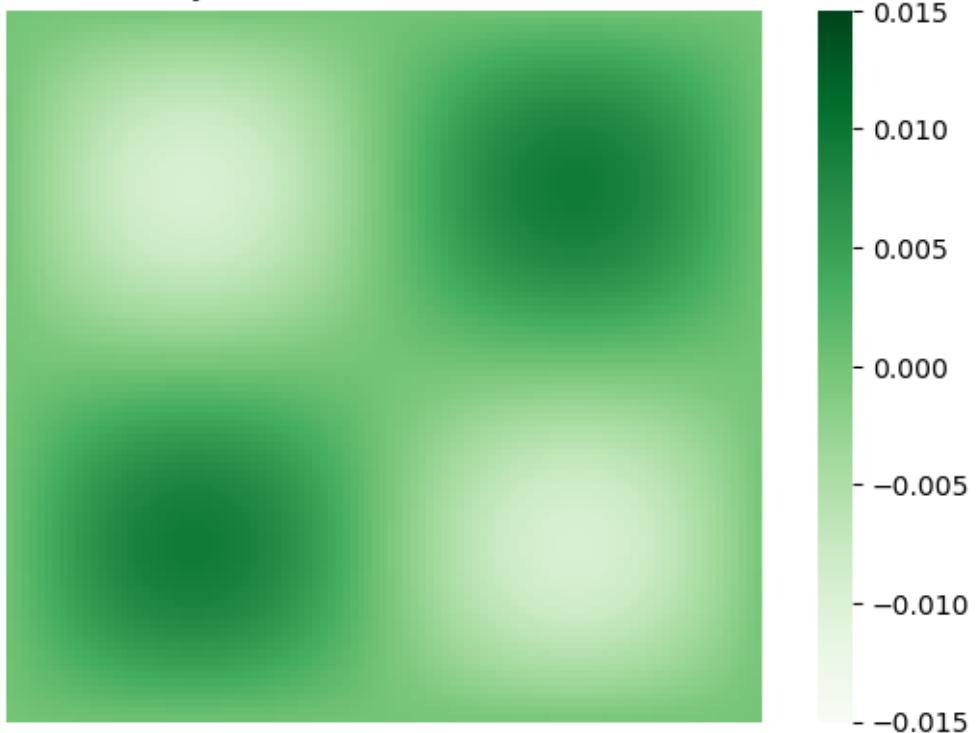
Q_4_Analytical_Solution_at_time_0.870000_.csv

Analytical Solution: Time = 0.87



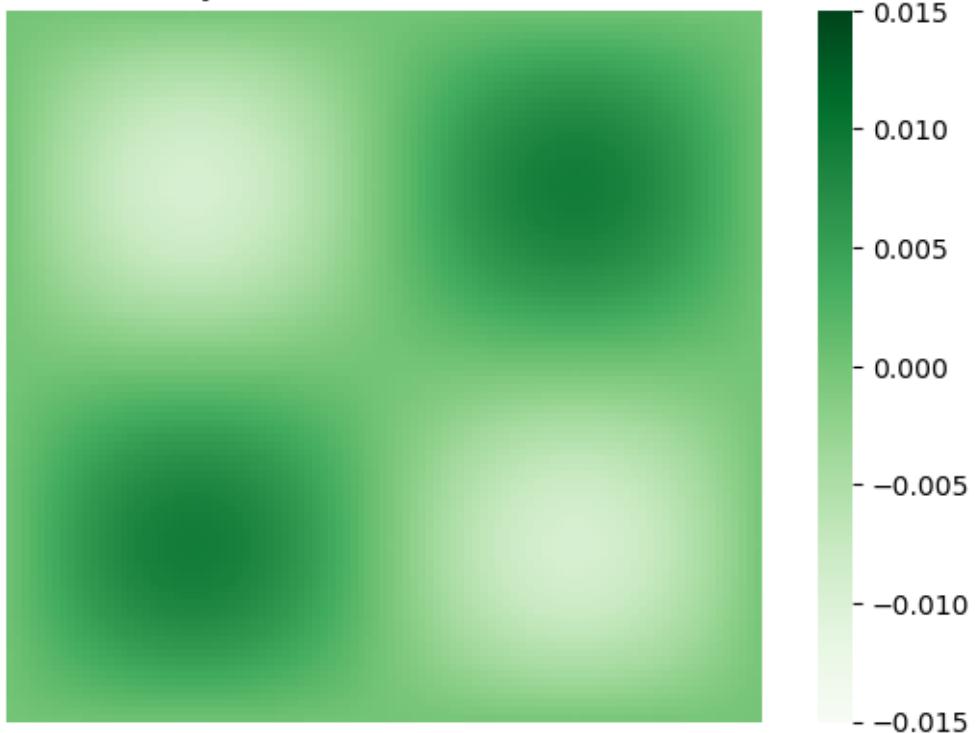
Q_4_Analytical_Solution_at_time_0.875000_.csv

Analytical Solution: Time = 0.875



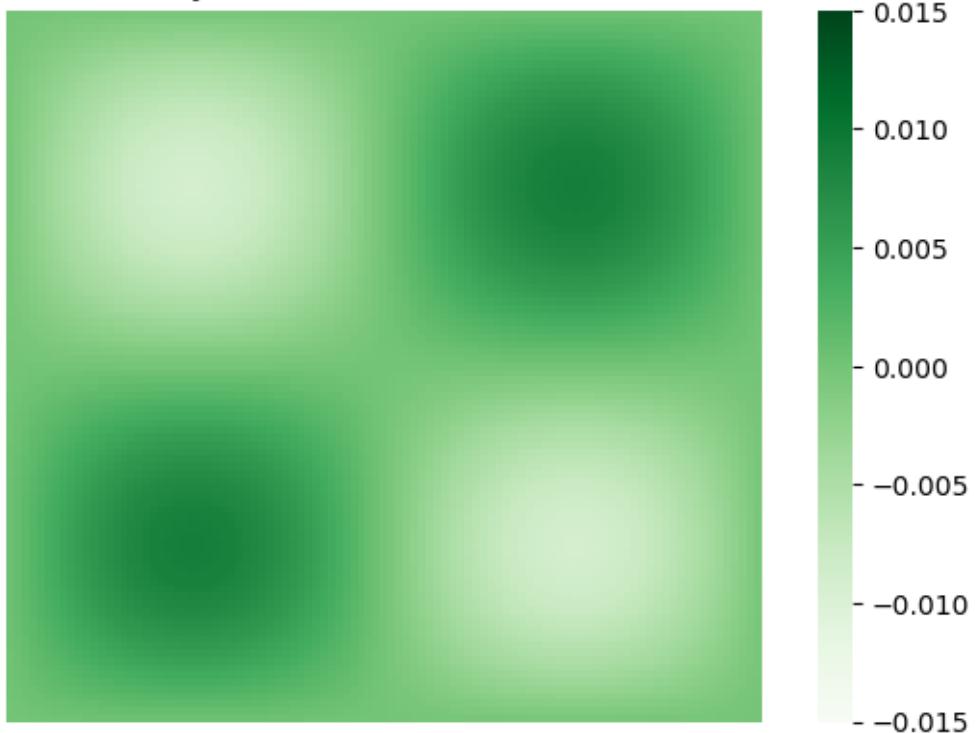
Q_4_Analytical_Solution_at_time_0.880000_.csv

Analytical Solution: Time = 0.88



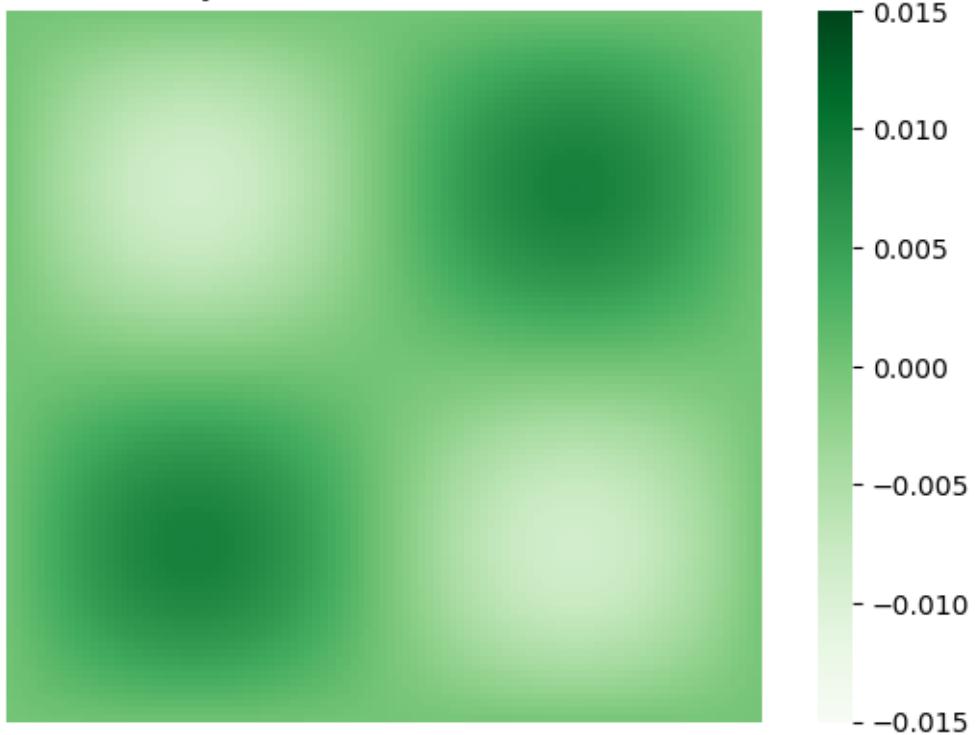
Q_4_Analytical_Solution_at_time_0.885000_.csv

Analytical Solution: Time = 0.885



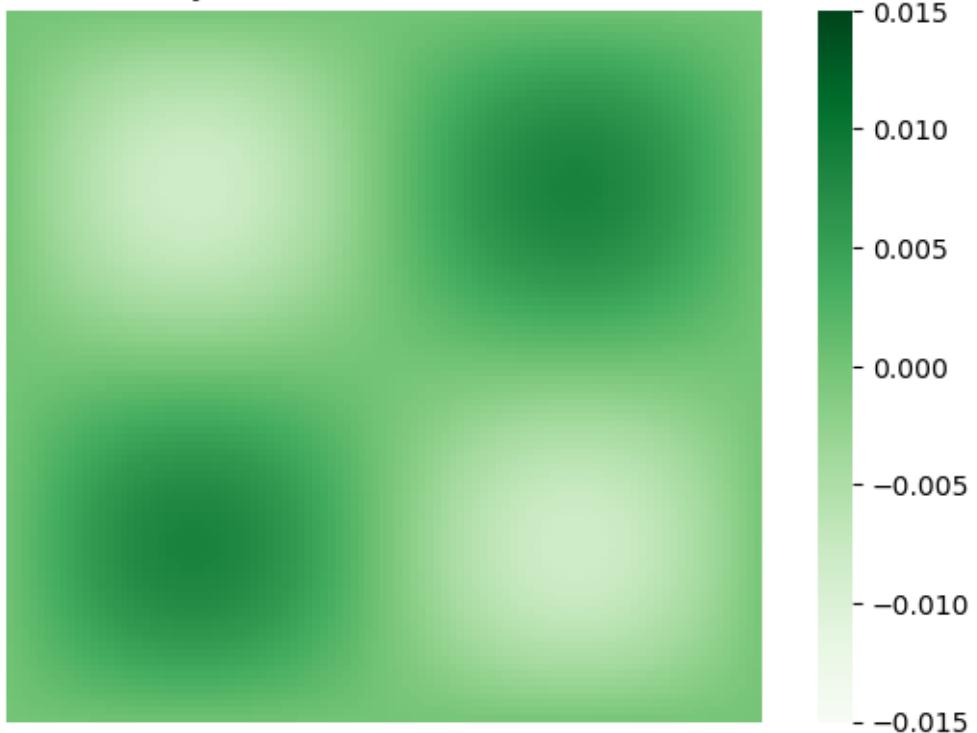
Q_4_Analytical_Solution_at_time_0.890000_.csv

Analytical Solution: Time = 0.89



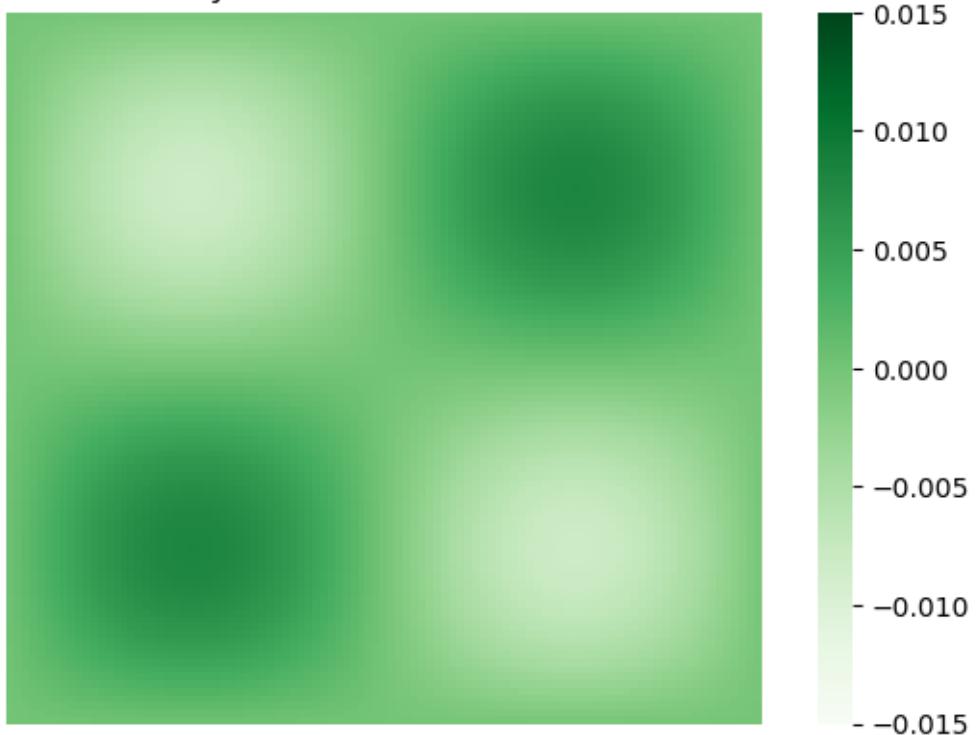
Q_4_Analytical_Solution_at_time_0.895000_.csv

Analytical Solution: Time = 0.895



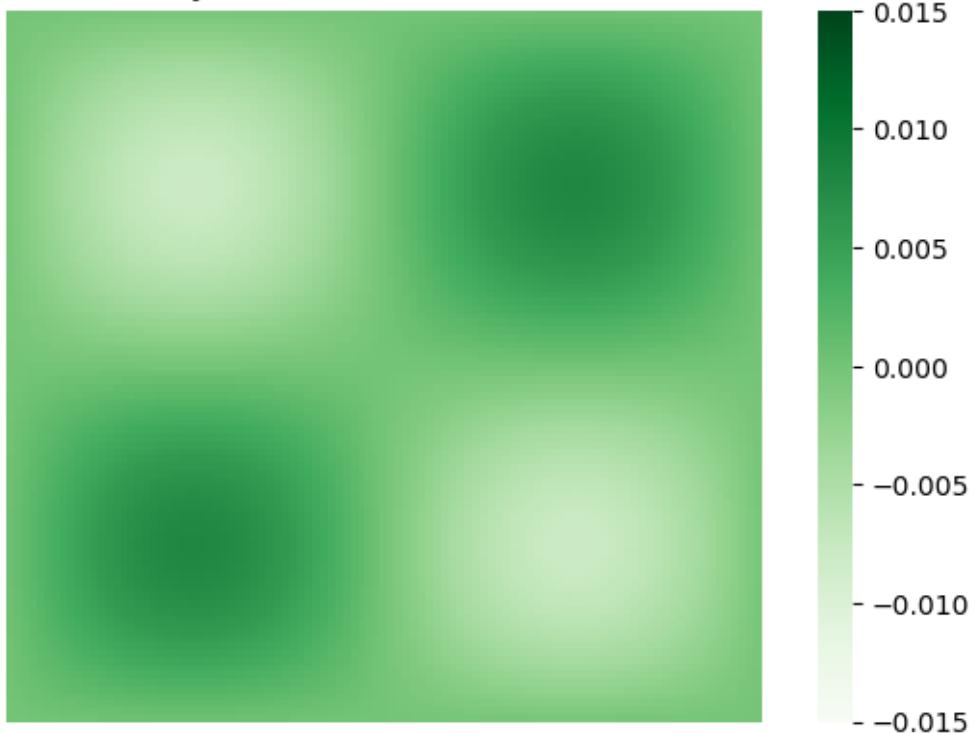
Q_4_Analytical_Solution_at_time_0.900000_.csv

Analytical Solution: Time = 0.9



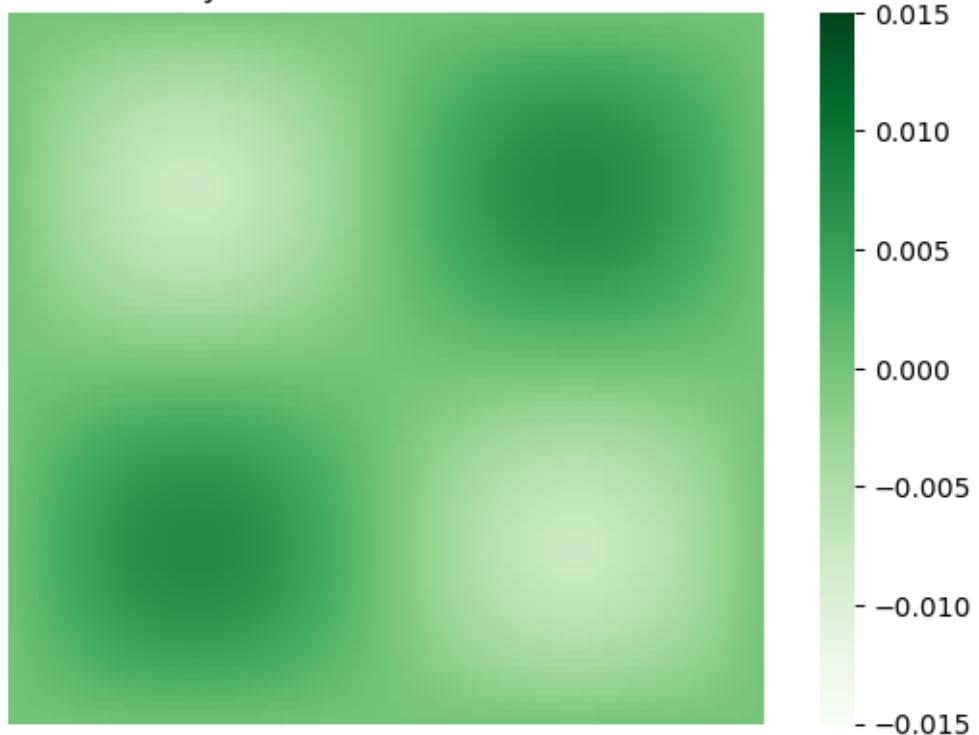
Q_4_Analytical_Solution_at_time_0.905000_.csv

Analytical Solution: Time = 0.905



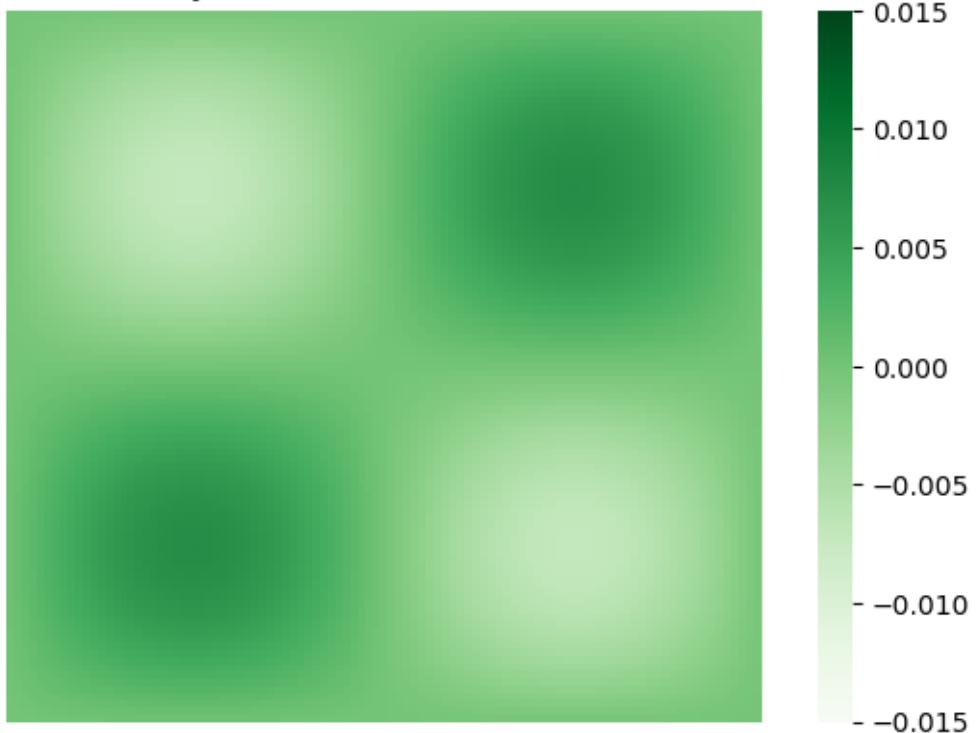
Q_4_Analytical_Solution_at_time_0.910000_.csv

Analytical Solution: Time = 0.91



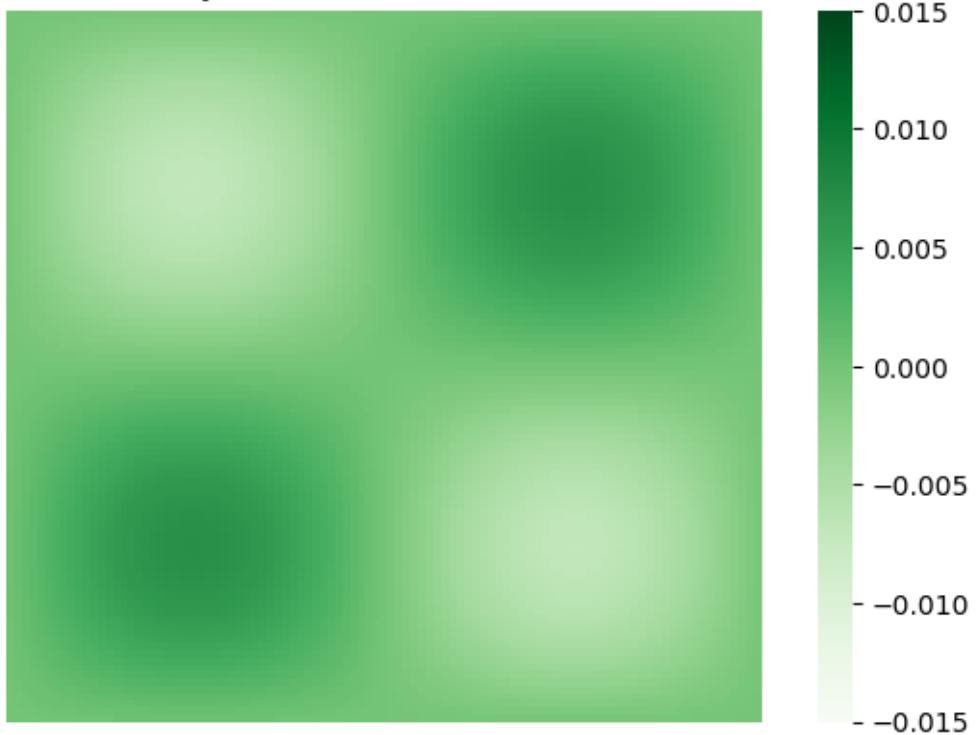
Q_4_Analytical_Solution_at_time_0.915000_.csv

Analytical Solution: Time = 0.915



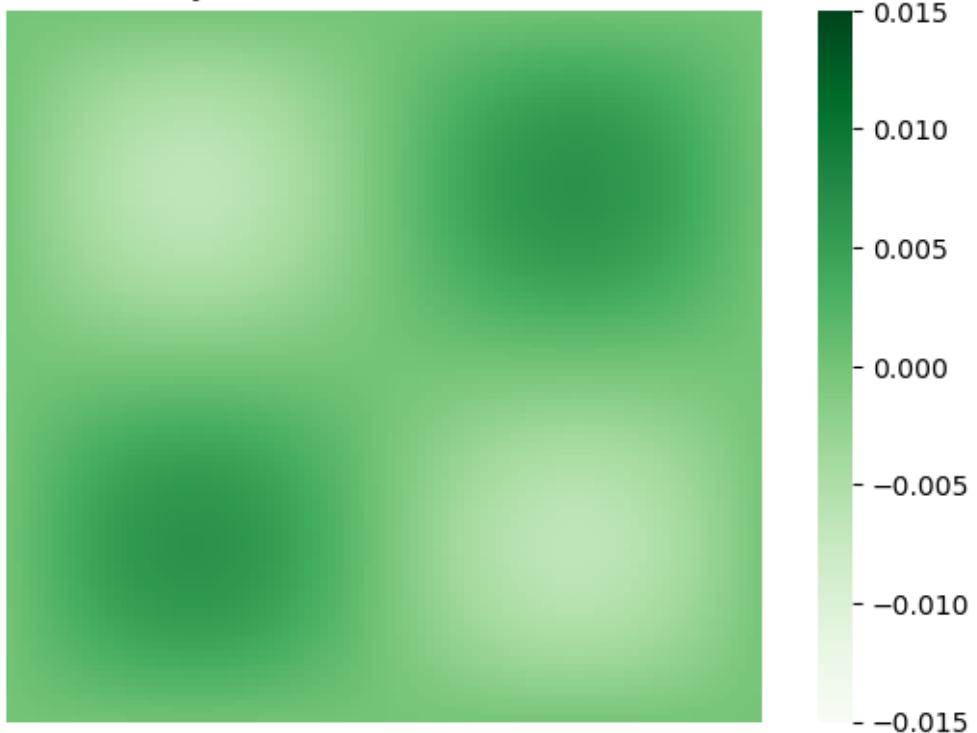
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Analytical Solution: Time = 0.92



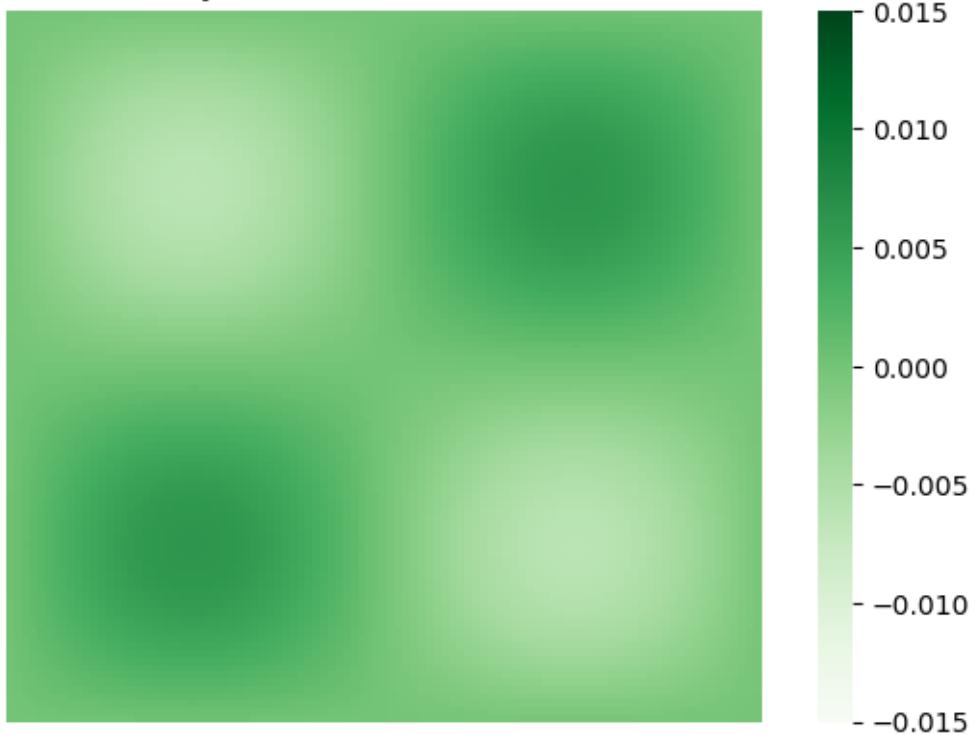
Q_4_Analytical_Solution_at_time_0.925000_.csv

Analytical Solution: Time = 0.925



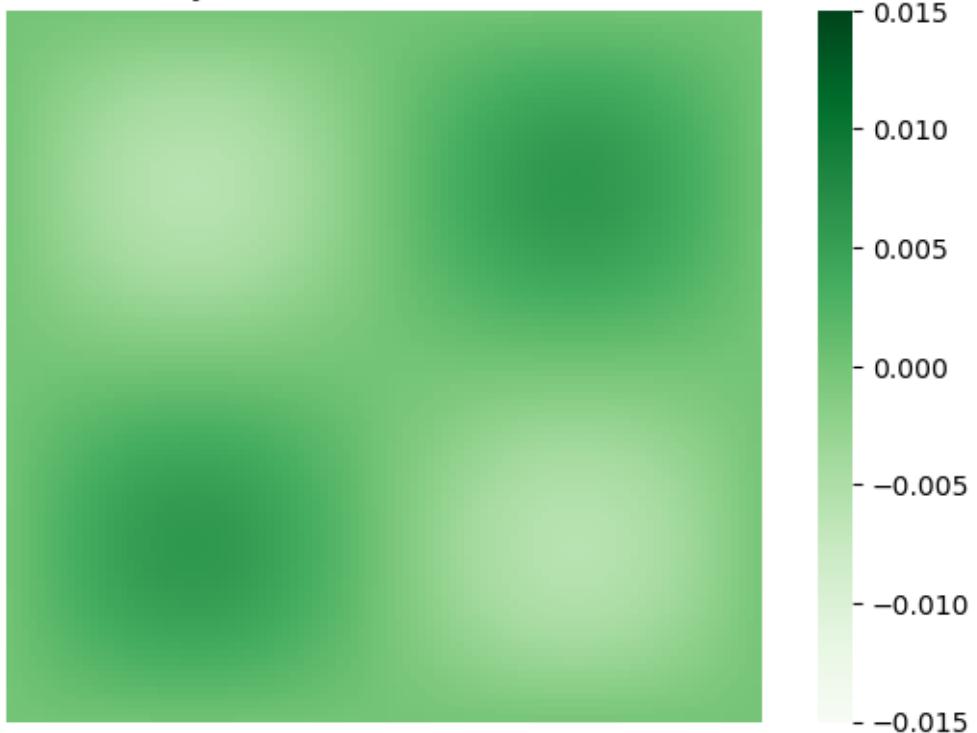
Q_4_Analytical_Solution_at_time_0.930000_.csv

Analytical Solution: Time = 0.93



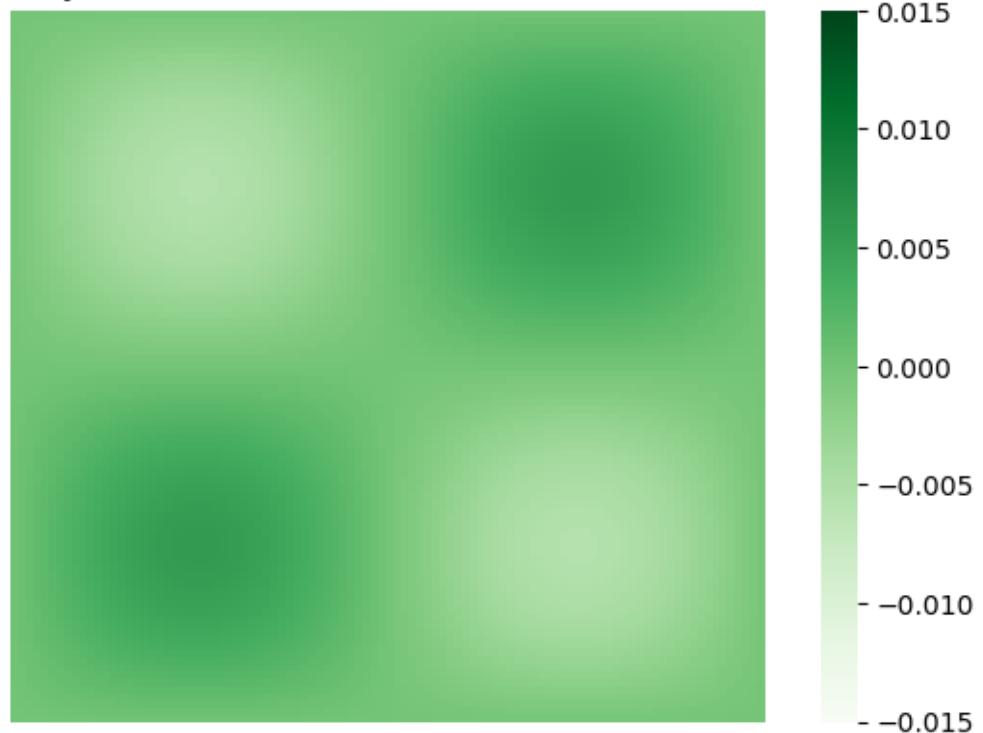
Q_4_Analytical_Solution_at_time_0.935000_.csv

Analytical Solution: Time = 0.935



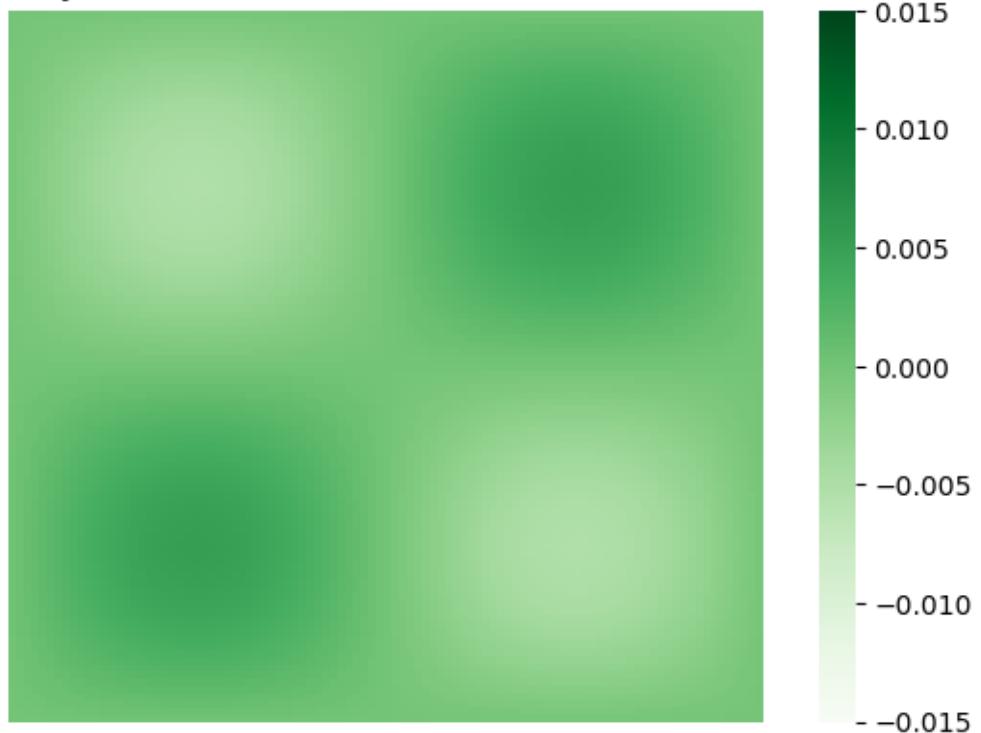
Q_4_Analytical_Solution_at_time_0.940000_.csv

Analytical Solution: Time = 0.9400000000000001



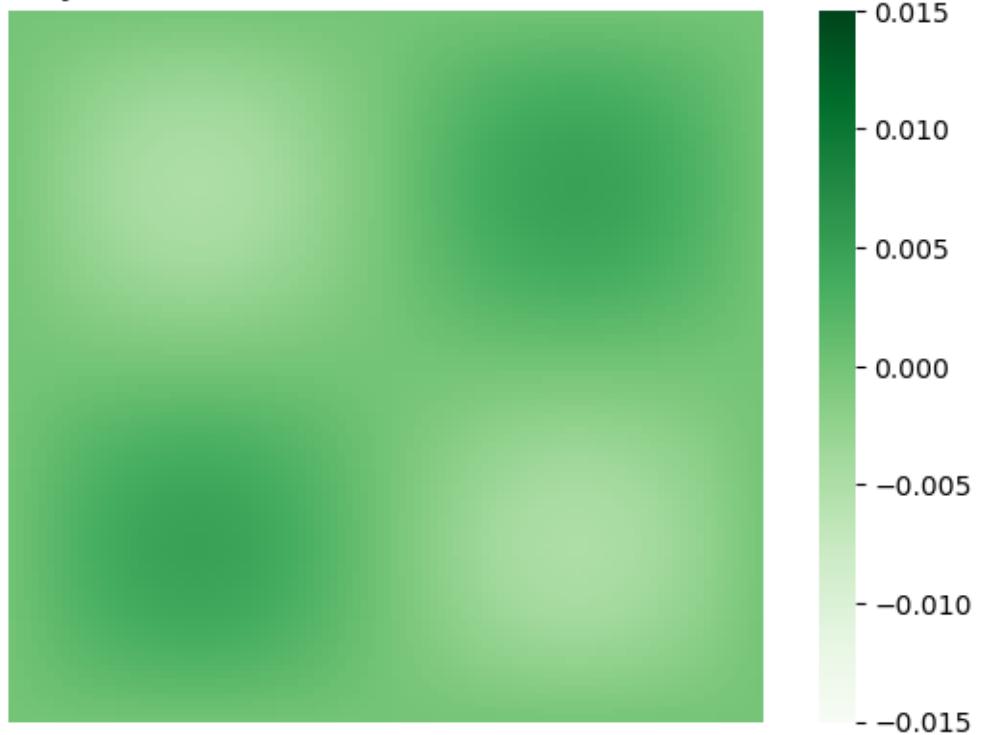
Q_4_Analytical_Solution_at_time_0.945000_.csv

Analytical Solution: Time = 0.9450000000000001



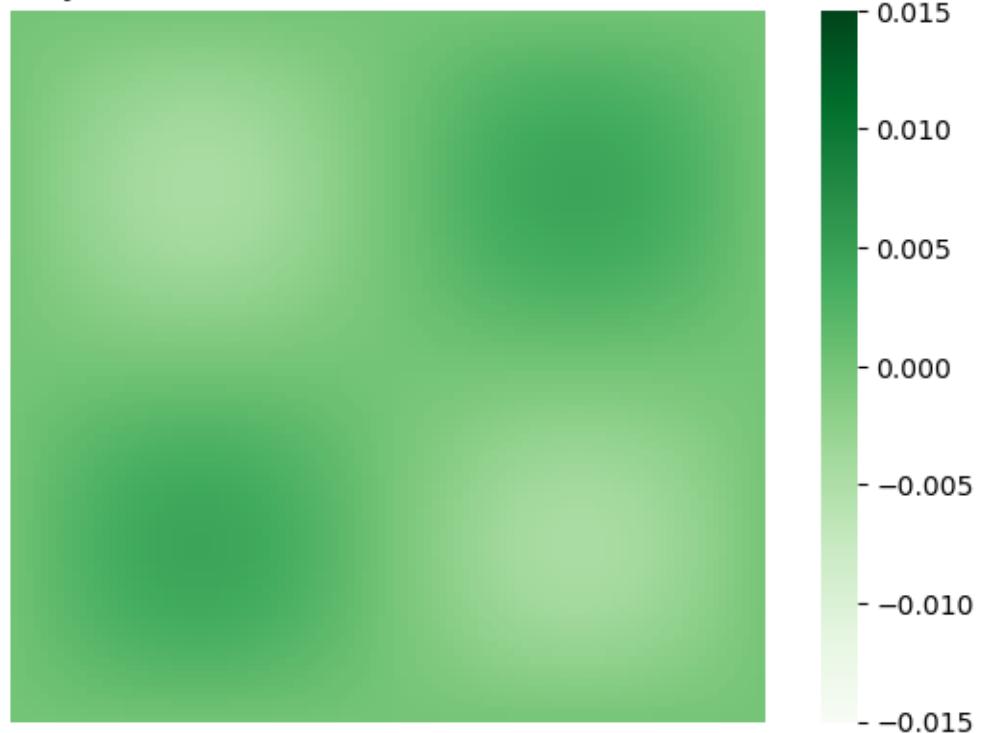
Q_4_Analytical_Solution_at_time_0.950000_.csv

Analytical Solution: Time = 0.9500000000000001



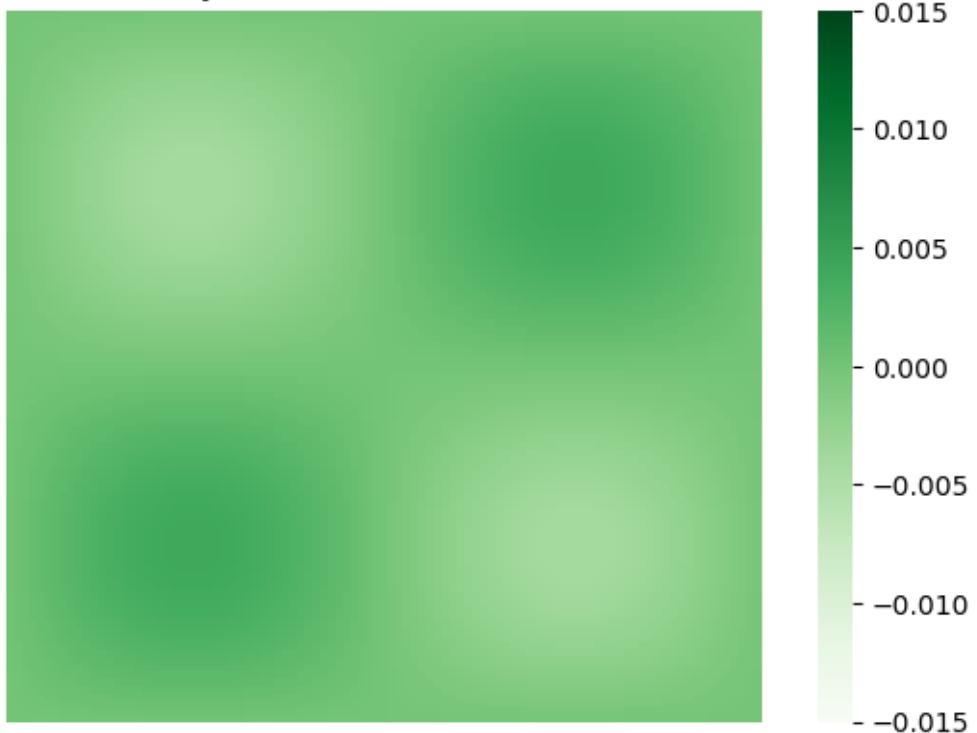
Q_4_Analytical_Solution_at_time_0.955000_.csv

Analytical Solution: Time = 0.9550000000000001



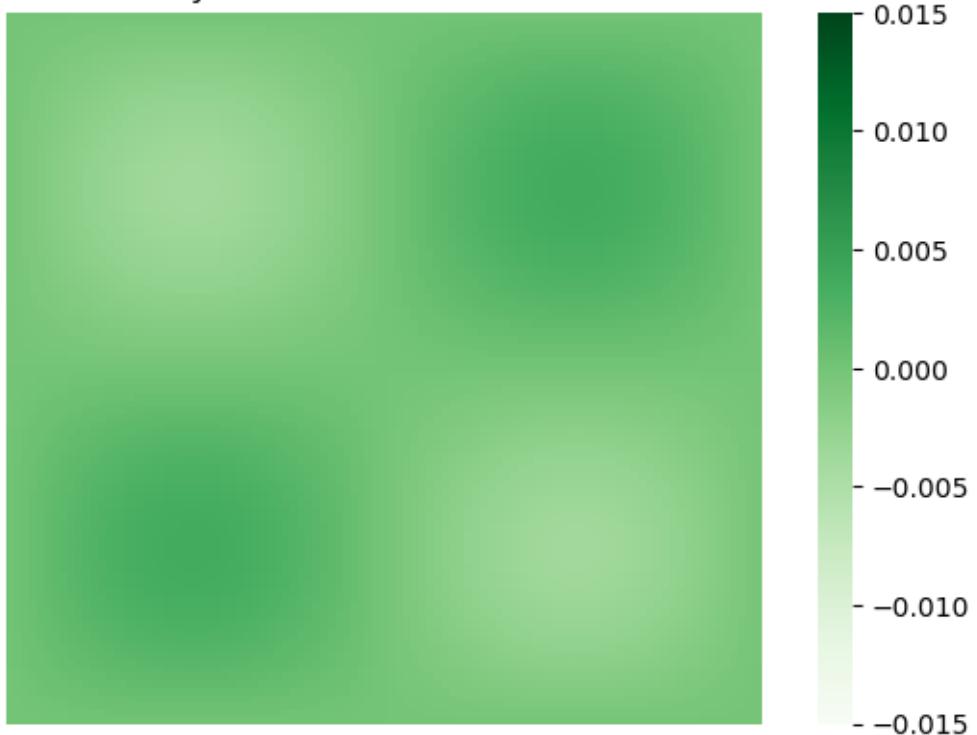
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Analytical Solution: Time = 0.96



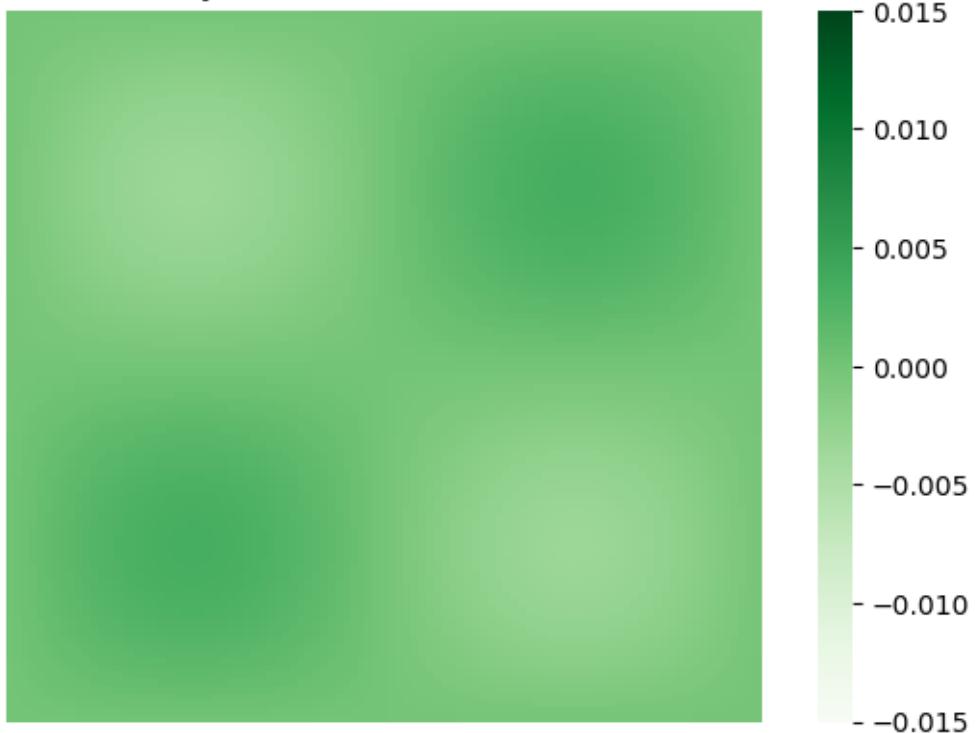
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Analytical Solution: Time = 0.965



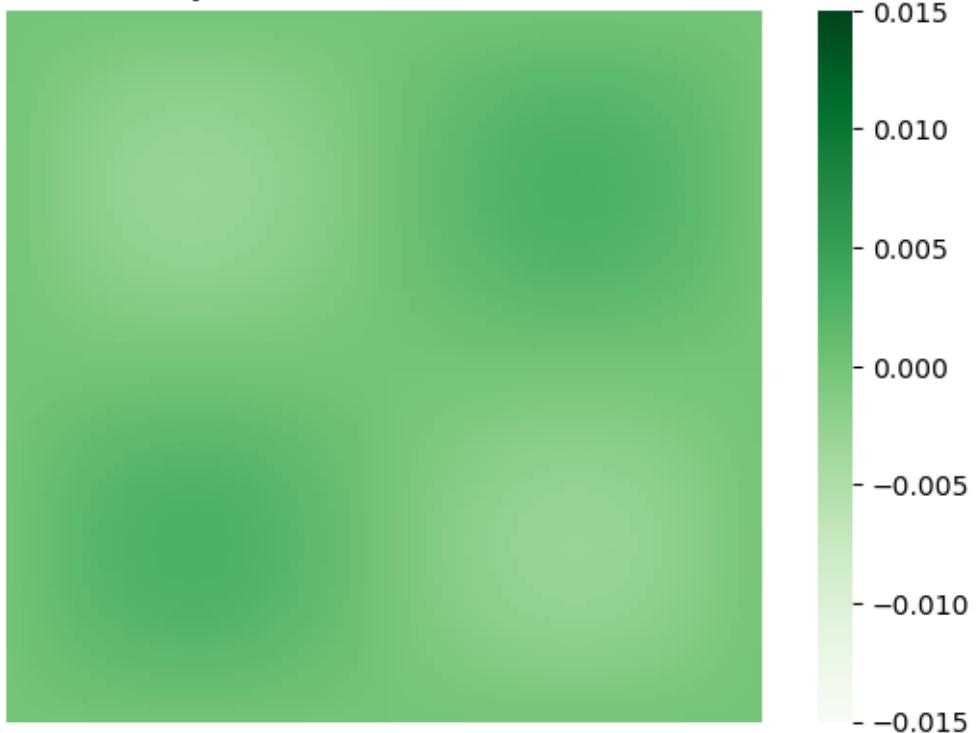
Q_4_Analytical_Solution_at_time_0.970000_.csv

Analytical Solution: Time = 0.97



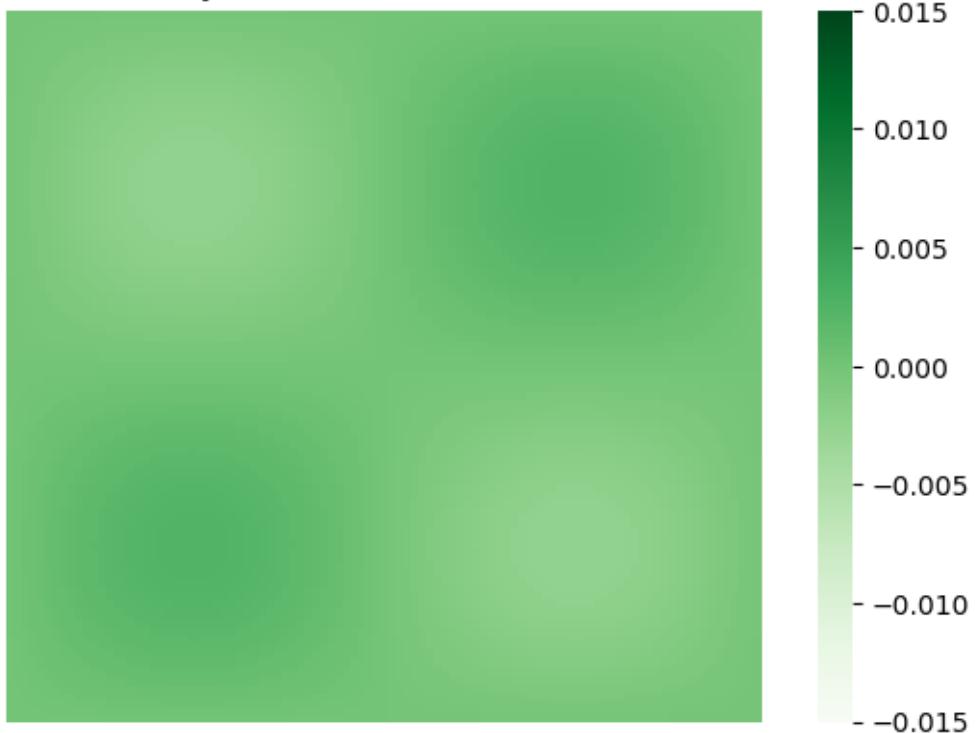
Q_4_Analytical_Solution_at_time_0.975000_.csv

Analytical Solution: Time = 0.975



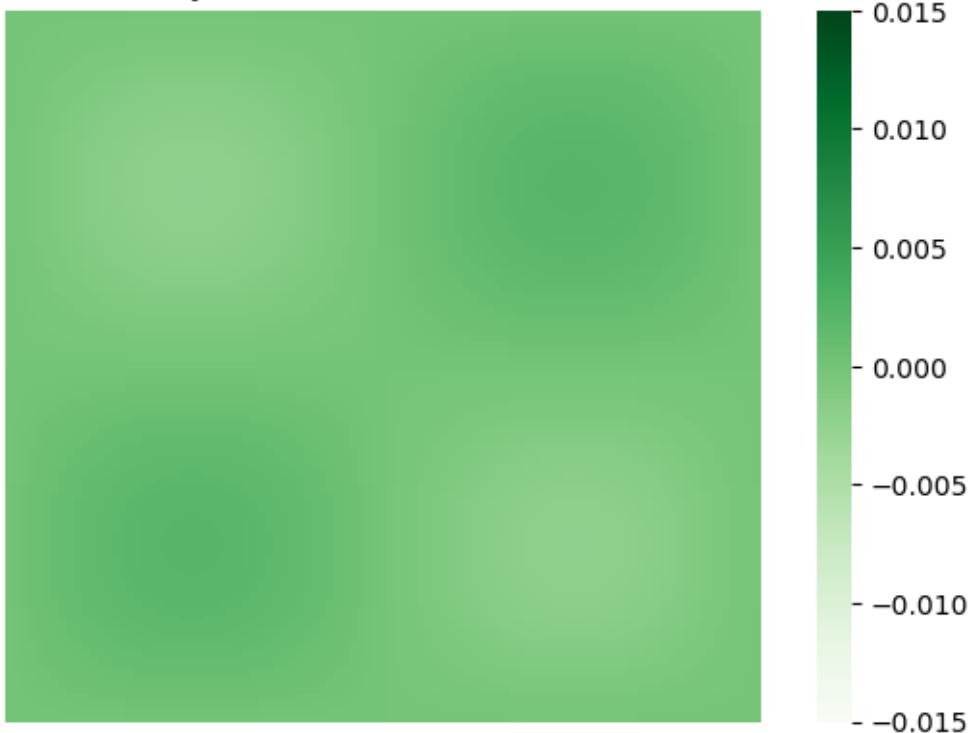
Q_4_Analytical_Solution_at_time_0.980000_.csv

Analytical Solution: Time = 0.98



Q_4_Analytical_Solution_at_time_0.985000_.csv

Analytical Solution: Time = 0.985



Q_4_Analytical_Solution_at_time_0.990000_.csv

Analytical Solution: Time = 0.99



Q_4_Analytical_Solution_at_time_0.995000_.csv