计算方法Lab2

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算法：

算法①：Gauss_Seidel迭代算法

算法②：列主元高斯消元法

算法均在书本上有描述和伪代码。

实验结果：

一、Gauss_Seidel迭代算法：

使用while结构控制算法，取精确度为$||Y1-Y2||_\infty<0.000001$时退出

```
while (InfiniteNorm(Y1,Y2) > 0.000001){
```

使用近似解与精确解的差的二范数来表示误差

得到结果如下：

ε = 1时：

```
0.0128144 0.0255514 0.038212 0.0507969 0.0633069 0.0757428 0.0881053 0.100395 0.112613 0.12476 0.136837 0.148844 0.160782
0.172652 0.184455 0.19619 0.20786 0.219464 0.231004 0.242479 0.253891 0.26524 0.276528 0.287753 0.298918 0.310023 0.321068
 0.332054 0.342981 0.353851 0.364664 0.37542 0.38612 0.396764 0.407354 0.417889 0.42837 0.438798 0.449173 0.459496 0.46976
7 0.479987 0.490157 0.500276 0.510346 0.520366 0.530338 0.540261 0.550137 0.559965 0.569747 0.579482 0.589171 0.598815 0.6
08413 0.617968 0.627478 0.636944 0.646367 0.655747 0.665084 0.67438 0.683633 0.692846 0.702017 0.711148 0.720239 0.729291
0.738302 0.747275 0.756209 0.765105 0.773963 0.782783 0.791567 0.800313 0.809023 0.817696 0.826334 0.834936 0.843503 0.852
035 0.860533 0.868996 0.877425 0.885821 0.894184 0.902513 0.91081 0.919074 0.927307 0.935507 0.943676 0.951814 0.95992 0.9
67997 0.976042 0.984058 0.992044
近似解与精确解的二范数为：0.00911198
```

ε = 0.1时：

```
0.0504163 0.0967041 0.139239 0.178362 0.214383 0.247585 0.278224 0.306533 0.332723 0.356988 0.379503 0.400426 0.419903 0.4
38064 0.45503 0.47091 0.485801 0.499794 0.51297 0.525404 0.537164 0.548309 0.558897 0.568978 0.578598 0.587799 0.596619 0.
605093 0.613251 0.621124 0.628736 0.636111 0.643271 0.650236 0.657022 0.663647 0.670125 0.676469 0.682692 0.688804 0.69481
5 0.700736 0.706573 0.712334 0.718027 0.723657 0.72923 0.734752 0.740227 0.745658 0.751051 0.756409 0.761734 0.767031 0.77
23 0.777545 0.782769 0.787972 0.793157 0.798325 0.803479 0.808618 0.813745 0.818861 0.823966 0.829062 0.834149 0.839229 0.
844301 0.849367 0.854427 0.859482 0.864532 0.869577 0.874619 0.879656 0.884691 0.889722 0.89475 0.899776 0.9048 0.909821 0
.914841 0.919859 0.924875 0.92989 0.934903 0.939916 0.944927 0.949937 0.954946 0.959955 0.964962 0.969969 0.974976 0.97998
2 0.984987 0.989992 0.994996
近似解与精确解的二范数为：0.039909
```

ε = 0.01时：

```
0.254993 0.38499 0.45249 0.488741 0.509367 0.522181 0.531088 0.538042 0.54402 0.549509 0.554754 0.559876 0.564937 0.569968
 0.574984 0.579992 0.584996 0.589998 0.594999 0.599999 0.605 0.61 0.615 0.62 0.625 0.63 0.635 0.64 0.645 0.65 0.655 0.66 0
.665 0.67 0.675 0.68 0.685 0.69 0.695 0.7 0.705 0.71 0.715 0.72 0.725 0.73 0.735 0.74 0.745 0.75 0.755 0.76 0.765 0.77 0.7
75 0.78 0.785 0.79 0.795 0.8 0.805 0.81 0.815 0.82 0.825 0.83 0.835 0.84 0.845 0.85 0.855 0.86 0.865 0.87 0.875 0.88 0.885
 0.89 0.895 0.9 0.905 0.91 0.915 0.92 0.925 0.93 0.935 0.94 0.945 0.95 0.955 0.96 0.965 0.97 0.975 0.98 0.985 0.99 0.995
近似解与精确解的二范数为：0.0988253
```

ε = 0.0001时：

```
0.500049 0.509951 0.515 0.52 0.525 0.53 0.535 0.54 0.545 0.55 0.555 0.56 0.565 0.57 0.575 0.58 0.585 0.59 0.595 0.6 0.605
0.61 0.615 0.62 0.625 0.63 0.635 0.64 0.645 0.65 0.655 0.66 0.665 0.67 0.675 0.68 0.685 0.69 0.695 0.7 0.705 0.71 0.715 0.
72 0.725 0.73 0.735 0.74 0.745 0.75 0.755 0.76 0.765 0.77 0.775 0.78 0.785 0.79 0.795 0.8 0.805 0.81 0.815 0.82 0.825 0.83
 0.835 0.84 0.845 0.85 0.855 0.86 0.865 0.87 0.875 0.88 0.885 0.89 0.895 0.9 0.905 0.91 0.915 0.92 0.925 0.93 0.935 0.94 0
.945 0.95 0.955 0.96 0.965 0.97 0.975 0.98 0.985 0.99 0.995
近似解与精确解的二范数为：0.00495083
```

二、列主元高斯消元法

ε = 1时：

```
0.0128543 0.0256309 0.0383305 0.0509538 0.0635016 0.0759748 0.0883739 0.1007 0.112953 0.125135 0.137245 0.149285 0.161255
0.173157 0.18499 0.196755 0.208453 0.220085 0.231652 0.243153 0.25459 0.265963 0.277273 0.288521 0.299707 0.310831 0.32189
5 0.332899 0.343844 0.354729 0.365557 0.376326 0.387039 0.397695 0.408294 0.418839 0.429329 0.439764 0.450145 0.460473 0.4
70749 0.480972 0.491143 0.501264 0.511333 0.521352 0.531322 0.541243 0.551114 0.560938 0.570714 0.580442 0.590124 0.599759
 0.609348 0.618892 0.628391 0.637846 0.647256 0.656623 0.665946 0.675227 0.684465 0.693661 0.702816 0.711929 0.721002 0.73
0035 0.739027 0.74798 0.756894 0.765769 0.774606 0.783405 0.792166 0.80089 0.809577 0.818228 0.826842 0.835421 0.843964 0.
852472 0.860946 0.869385 0.87779 0.886161 0.894499 0.902804 0.911076 0.919316 0.927523 0.935699 0.943844 0.951957 0.960039
 0.968091 0.976113 0.984105 0.992067
近似解与精确解的二范数为： 0.00216804
```

ε = 0.1时：

```
0.0504578 0.0967832 0.139352 0.178505 0.214553 0.247779 0.278439 0.306766 0.332972 0.357251 0.379777 0.400709 0.420194 0.4
38361 0.455332 0.471214 0.486107 0.5001 0.513276 0.525709 0.537466 0.548609 0.559193 0.56927 0.578885 0.588081 0.596895 0.
605362 0.613514 0.62138 0.628985 0.636353 0.643506 0.650464 0.657243 0.663861 0.670331 0.676668 0.682883 0.688988 0.694992
 0.700905 0.706736 0.71249 0.718176 0.7238 0.729367 0.734882 0.740351 0.745777 0.751164 0.756516 0.761836 0.767127 0.77239
1 0.777632 0.78285 0.788049 0.79323 0.798394 0.803543 0.808679 0.813802 0.818915 0.824017 0.829109 0.834194 0.83927 0.8443
4 0.849403 0.854461 0.859513 0.864561 0.869604 0.874643 0.879679 0.884711 0.889741 0.894768 0.899792 0.904814 0.909835 0.9
14853 0.91987 0.924885 0.929898 0.934911 0.939922 0.944933 0.949942 0.954951 0.959959 0.964966 0.969972 0.974978 0.979983
0.984988 0.989992 0.994996
近似解与精确解的二范数为： 0.0383679
```

ε = 0.01时：

```
0.255 0.385 0.4525 0.48875 0.509375 0.522188 0.531094 0.538047 0.544023 0.549512 0.554756 0.559878 0.564939 0.569969 0.574
985 0.579992 0.584996 0.589998 0.594999 0.6 0.605 0.61 0.615 0.62 0.625 0.63 0.635 0.64 0.645 0.65 0.655 0.66 0.665 0.67 0
.675 0.68 0.685 0.69 0.695 0.7 0.705 0.71 0.715 0.72 0.725 0.73 0.735 0.74 0.745 0.75 0.755 0.76 0.765 0.77 0.775 0.78 0.7
85 0.79 0.795 0.8 0.805 0.81 0.815 0.82 0.825 0.83 0.835 0.84 0.845 0.85 0.855 0.86 0.865 0.87 0.875 0.88 0.885 0.89 0.895
 0.9 0.905 0.91 0.915 0.92 0.925 0.93 0.935 0.94 0.945 0.95 0.955 0.96 0.965 0.97 0.975 0.98 0.985 0.99 0.995
近似解与精确解的二范数为： 0.0988074
```

ε = 0.0001时：

```
0.50005 0.509951 0.515 0.52 0.525 0.53 0.535 0.54 0.545 0.55 0.555 0.56 0.565 0.57 0.575 0.58 0.585 0.59 0.595 0.6 0.605 0
.61 0.615 0.62 0.625 0.63 0.635 0.64 0.645 0.65 0.655 0.66 0.665 0.67 0.675 0.68 0.685 0.69 0.695 0.7 0.705 0.71 0.715 0.7
2 0.725 0.73 0.735 0.74 0.745 0.75 0.755 0.76 0.765 0.77 0.775 0.78 0.785 0.79 0.795 0.8 0.805 0.81 0.815 0.82 0.825 0.83
0.835 0.84 0.845 0.85 0.855 0.86 0.865 0.87 0.875 0.88 0.885 0.89 0.895 0.9 0.905 0.91 0.915 0.92 0.925 0.93 0.935 0.94 0.
945 0.95 0.955 0.96 0.965 0.97 0.975 0.98 0.985 0.99 0.995
近似解与精确解的二范数为： 0.00495074
```

分析：

①两种算法下，$||Y1-Y2||_2$均在0.01左右，说明近似得比较好，精确解与近似解在0.001的精确度上都一样，在这个精确度下作图也难以肉眼看出差别。

②两种算法都比较稳定，不会因为系数ε的剧烈变化而导致精确性的剧烈变化。