## NSGA-II实验结果

#### 1、Pareto Front

##### 1、SCH







##### 2、KUR







##### 3、FON







#### 主要参数

交叉算子：单点交叉（Pc=0.9）

变异算子：位点变异（Pm=1/编码二进制位数）

编码方式：二进制编码

种群规模：N=80

迭代次数：1000

#### 3、Optimal Solutions

|  |  |  |
| --- | --- | --- |
| SCH（n=1） | KUR（n=3） | FON（n=3） |
| 1.999999  0.000001  1.999944  1.999975  1.999940  1.999938  1.999999  1.673254  0.414181  0.832639  1.632725  1.953126  1.999940  0.656133  1.571718  1.901769  1.815801  1.731877  0.000001  1.999854  0.000001  0.000001  0.000001  0.000001  0.000001  0.793458  0.854493  0.000001  0.000001  0.549317  0.428201  0.000001  1.052232  1.172584  0.000008  0.615719  0.051034  0.009445  0.976563  0.686212  0.000120  0.075669  1.404763  0.000001  0.000005  0.172616  0.122071  0.226528  0.172627  1.271737  0.270964  0.684292  1.465798  0.319333  1.586915  1.999854  0.366212  0.244320  1.754821  1.999856  1.914983  1.243862  1.999938  1.076779  1.815858  1.976284  1.327575  0.693400  1.146602  1.220738  1.999999  1.862618  1.453460  1.510638  1.984741  0.935690  1.389588  1.358273  1.999888  1.456742 | -0.000001 0.000001 -0.000001  -1.152303 -1.152749 -1.152802  -1.049805 0.004895 -1.074682  -1.015936 0.000318 -1.074776  -1.152303 -1.152749 -1.152802  -1.080875 -0.701500 -1.093934  -0.000001 0.000001 -0.682687  -1.090552 -0.642383 -1.074837  -1.044557 -1.090905 -1.078236  -0.000002 0.000075 -1.054997  -0.000001 0.000356 -1.016240  -1.050419 -0.936889 -1.058398  -0.000001 0.000001 -1.068166  -0.981456 -0.932260 -1.104453  -0.000001 0.000001 -0.950167  -0.000001 0.000001 -0.879520  -1.109020 -0.958154 -1.074709  -0.996644 -1.003711 -1.074677  -0.000003 0.000001 -0.847659  -0.000002 0.000060 -0.723274  -1.040135 0.007346 -1.133129  -0.000001 0.000003 -0.765726  -1.088886 -0.779626 -1.075158  -0.947273 0.000013 -0.898765  -0.000001 0.000013 -0.535159  -0.000040 0.000032 -0.810856  -0.000001 0.017417 -0.995187  -1.080560 -0.830055 -1.093925  -1.049805 0.004886 -0.879526  -0.000001 0.000003 -0.976744  -0.000001 0.000040 -0.643625  -0.000001 0.000040 -0.586396  -0.981446 0.000003 -0.976747  -1.093862 -1.152855 -1.093925  -1.070559 -1.003720 -1.152802  -1.090791 -1.093671 -1.074677  -1.041889 -0.779626 -1.075196  -0.986336 0.000013 -0.899434  -1.090089 0.000357 -1.094437  -0.731202 0.000001 -0.000004  -1.050510 -0.830078 -1.068166  -0.996094 0.000002 -0.950167  -0.947273 0.009804 -0.879520  -1.041961 0.000001 -0.000004  -1.093140 0.017417 -0.995187  -0.000003 0.000032 -0.912175  -1.093140 0.000003 -0.976744  -0.957032 0.001320 -1.101259  -1.074769 -1.003711 -1.055375  -0.000003 0.000032 -0.813807  -1.081407 -0.642383 -1.054997  -0.009773 0.000013 -0.898765  -0.000002 0.000075 -0.762205  -1.041961 0.000001 -0.950166  -0.000001 0.000040 -0.625175  -1.152303 -1.152749 -1.112375  -1.079692 -1.003711 -1.093934  -1.030892 0.000013 -0.898765  -0.000001 0.000032 -1.123356  -1.051654 -0.779626 -1.075196  -1.030886 -0.932574 -1.152802  -0.000001 0.000182 -0.840307  -0.006104 0.000040 -0.613253  -1.152303 -1.152749 -1.094212  -1.090791 -1.093738 -1.074837  -1.051490 -0.642383 -1.068166  -1.074219 0.000040 -0.586396  -1.041871 0.007651 -0.977025  -0.986336 0.000001 -0.879520  -0.000002 0.000001 -0.625615  -0.981456 -0.932260 -1.094746  -1.093140 0.000002 -0.605931  -0.937501 0.000001 -0.879520  -0.000002 0.000032 -0.931702  -1.118260 0.007346 -1.133129  -1.041872 0.022033 -0.723274  -1.050721 0.000001 -0.682687  -0.000003 0.000032 -0.912171  -1.093140 0.000040 -0.586396  -1.059572 0.000060 -0.723274 | -0.562495 -0.625001 -0.577485  0.578126 0.499999 0.577132  0.578126 0.499999 0.577129  0.578126 0.499999 0.577127  0.578126 0.499999 0.577127  -0.431451 -0.210601 -0.317414  0.578126 0.499999 0.577127  0.578126 0.499999 0.577129  -0.149407 -0.218413 -0.067479  -0.149400 -0.218404 0.131555  0.290088 0.230815 0.131499  0.578126 0.499999 0.557384  0.136844 0.073104 0.000396  0.069110 0.027680 0.014598  0.250384 0.323098 0.467691  0.415040 0.499999 0.572707  0.250293 0.183909 0.014548  0.578126 0.499999 0.571197  0.352573 0.249984 0.307082  -0.149407 -0.218413 -0.303804  0.068500 -0.176957 0.000457  0.199374 0.073100 0.030242  0.375384 0.353997 0.352325  0.003680 0.000594 0.014556  0.383790 0.499999 0.577127  0.138797 0.074203 0.369290  0.068500 -0.187394 0.006736  0.578126 0.484189 0.452117  0.352573 0.248529 0.295726  0.290088 0.183940 0.014548  -0.149407 -0.218413 -0.324067  0.578143 0.326516 0.467437  0.578126 0.484189 0.452117  0.137717 0.249505 0.350305  0.199374 0.073100 0.030227  0.344743 0.499751 0.577033  0.200217 0.249505 0.321181  0.578126 0.499999 0.577048  0.578126 0.499999 0.577033  0.196067 0.355453 0.307078  0.554687 0.561504 0.577350  -0.578248 -0.499999 -0.577424  -0.578248 -0.499999 -0.577424  -0.578248 -0.499902 -0.392861  -0.580115 -0.496093 -0.577186  -0.578248 -0.425073 -0.392861  -0.578248 -0.499902 -0.392884  -0.297011 -0.439263 -0.377351  -0.105601 -0.158013 -0.252235  -0.018559 0.111133 0.129607  -0.522737 -0.428979 -0.392861  0.054551 -0.031764 -0.008100  -0.523561 -0.429042 -0.453042  -0.517615 -0.492187 -0.320718  -0.105605 -0.156749 -0.077918  -0.226691 -0.198756 -0.143561  -0.018559 0.111133 0.241908  0.325175 0.172582 -0.014924  -0.152480 -0.000758 -0.015418  -0.297008 -0.439263 -0.252235  -0.145156 -0.127711 -0.014924  -0.517615 -0.355281 -0.320588  -0.226699 -0.191241 -0.252229  -0.226729 -0.202960 -0.327424  -0.578256 -0.390399 -0.327424  -0.226693 -0.390399 -0.326448  0.357402 0.061503 0.514850  -0.517615 -0.492187 -0.320722  -0.226729 -0.237573 -0.378823  -0.226729 -0.237573 -0.378823  0.356425 0.172412 0.176421  -0.518586 -0.428979 -0.392861  -0.297011 -0.439263 -0.252229  -0.027480 -0.031764 -0.015418  0.325175 0.172412 0.184161  -0.297011 -0.439263 -0.252229  -0.518592 -0.499999 -0.569375  -0.518592 -0.499999 -0.577180  0.054551 -0.031764 -0.077424  -0.105605 -0.156749 -0.077439 |

#### 4、体会

算法希望找到Pareto前沿上均匀分布的解，从而使决策者有多种选择，但是不合适的交叉、变异参数有可能导致最终的Pareto解集收敛到一个边界点（在测试SCH函数中，Pareto解有可能只找到（4,0）或者（0,4））

NSGA-II使用了快速非支配排序算法，并且在上一代父代和子代的并集中使用精英策略选择下一代的父代，进行交叉、变异生成子代，减小了算法的运算开销。