

Svanberg's (strict) conservatism

See algorithm in appended Python code.

The objective and constraint function is given verbatim below.

(Notice the naive choice of (a quadratic approximation to) a reciprocal intervening variable based function, dd...)

```
#
import numpy as np
#
def obj(x):
#
    a = 1.; b = 32.; c = -1.
    f = a*np.sin(b*x)*np.exp(c*x)
    df = a*c*np.sin(b*x)*np.exp(c*x) + a*b*np.exp(c*x)*np.cos(b*x)
#   ddf = a*c*b*np.cos(b*x)*np.exp(c*x) + a*c*c*np.sin(b*x)*np.exp(c*x) \
#       + a*c*b*np.exp(c*x)*np.cos(b*x) - a*b*b*np.exp(c*x)*np.sin(b*x)
    ddf = abs(-2./x*df) # quad. approx. to reciprocal intervening variables
#
    return [f, df, ddf]
#
def con(x):
#
    a = 1./4.; b = 32.
    g = a*np.cos(b*x)+0.1
    dg = -a*b*np.sin(b*x)
#   ddg = -a*b*b*np.cos(b*x)
    ddg = abs(-2./x*dg) # quad. approx. to reciprocal intervening variables
#
    return [g, dg, ddg]
#
```

QP subproblem at x^k :

$$x^k = 0.500$$

$$F^k = -0.175$$

$$d_x^k F = -18.413$$

$$dd_x^k \tilde{F} = 73.650$$

$$\alpha_F = 1.000$$

$$G^k = -0.139$$

$$d_x^k G = 2.303$$

$$dd_x^k \tilde{G} = 9.213$$

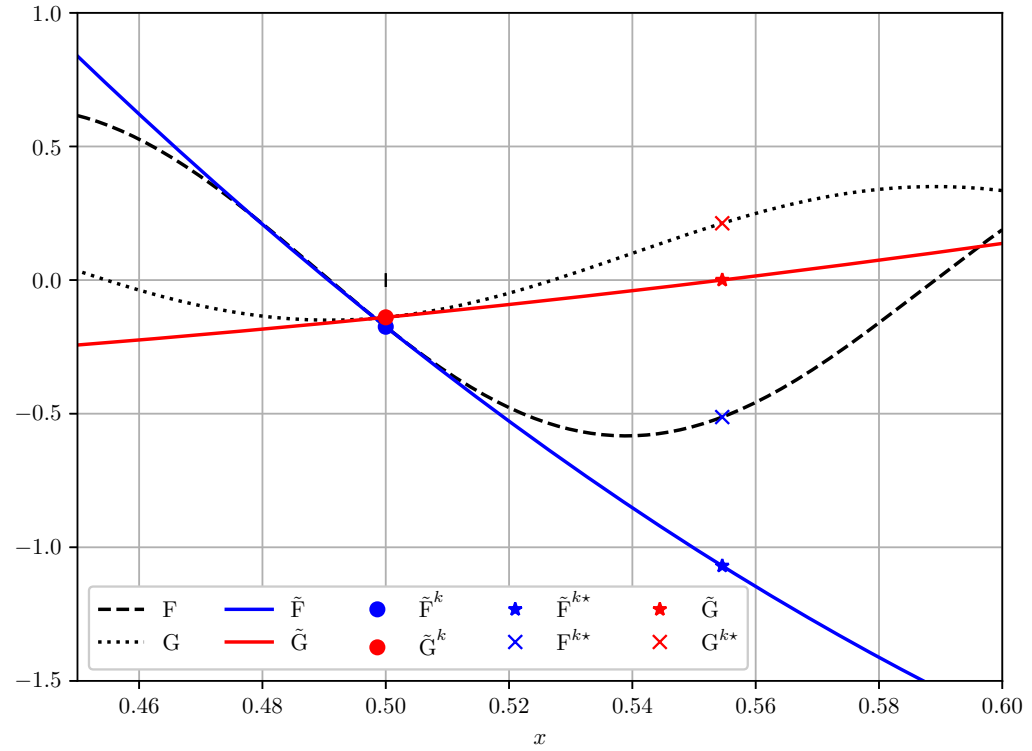
$$\alpha_G = 1.000$$

with Lagrange multiplier

$$\lambda^{k*} = 5.129$$

at the solution

$$x^{k*} = 0.555$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -1.070e + 00$$

$$\tilde{G}^{k*} = -3.929e - 10$$

while the actual functions are evaluated to be

$$F^{k*} = -5.127e - 01$$

$$G^{k*} = 2.127e - 01$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.500$$

$$F^k = -0.175$$

$$d_x^k F = -18.413$$

$$dd_x^k \tilde{F} = 73.650$$

$$\alpha_F = 2.000$$

$$G^k = -0.139$$

$$d_x^k G = 2.303$$

$$dd_x^k \tilde{G} = 9.213$$

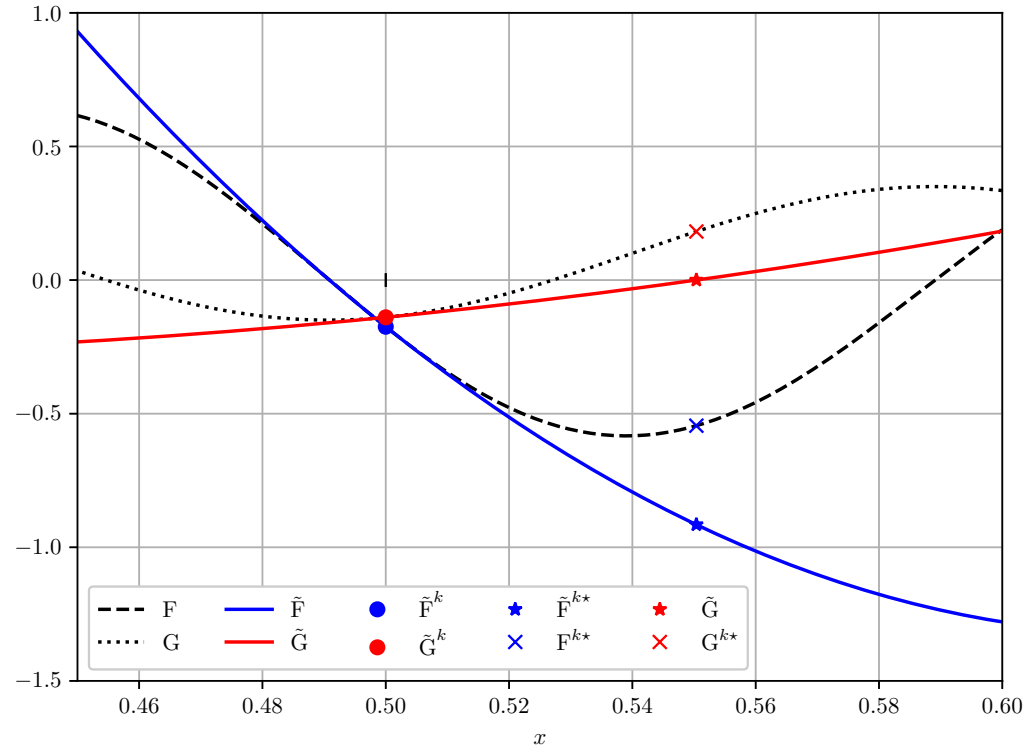
$$\alpha_G = 2.000$$

with Lagrange multiplier

$$\lambda^{k*} = 3.401$$

at the solution

$$x^{k*} = 0.550$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -9.153e - 01$$

$$\tilde{G}^{k*} = -1.680e - 10$$

while the actual functions are evaluated to be

$$F^{k*} = -5.450e - 01$$

$$G^{k*} = 1.818e - 01$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.500$$

$$F^k = -0.175$$

$$d_x^k F = -18.413$$

$$dd_x^k \tilde{F} = 73.650$$

$$\alpha_F = 4.000$$

$$G^k = -0.139$$

$$d_x^k G = 2.303$$

$$dd_x^k \tilde{G} = 9.213$$

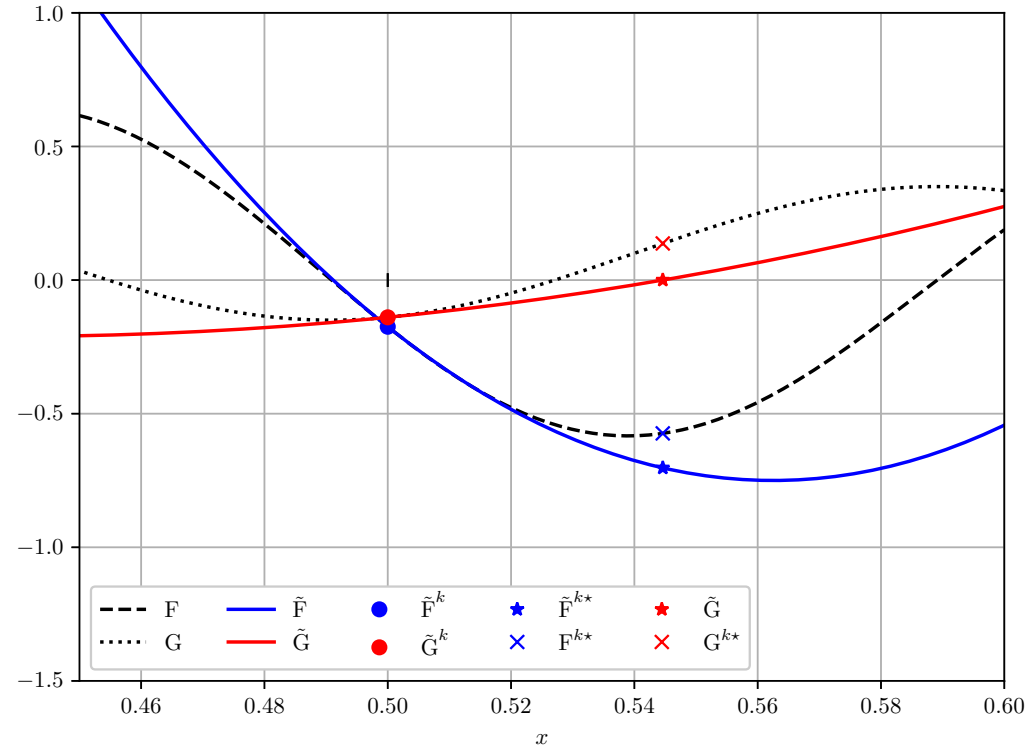
$$\alpha_G = 4.000$$

with Lagrange multiplier

$$\lambda^{k*} = 1.335$$

at the solution

$$x^{k*} = 0.545$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -7.029e - 01$$

$$\tilde{G}^{k*} = -4.449e - 11$$

while the actual functions are evaluated to be

$$F^{k*} = -5.737e - 01$$

$$G^{k*} = 1.371e - 01$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.500$$

$$F^k = -0.175$$

$$d_x^k F = -18.413$$

$$dd_x^k \tilde{F} = 73.650$$

$$\alpha_F = 8.000$$

$$G^k = -0.139$$

$$d_x^k G = 2.303$$

$$dd_x^k \tilde{G} = 9.213$$

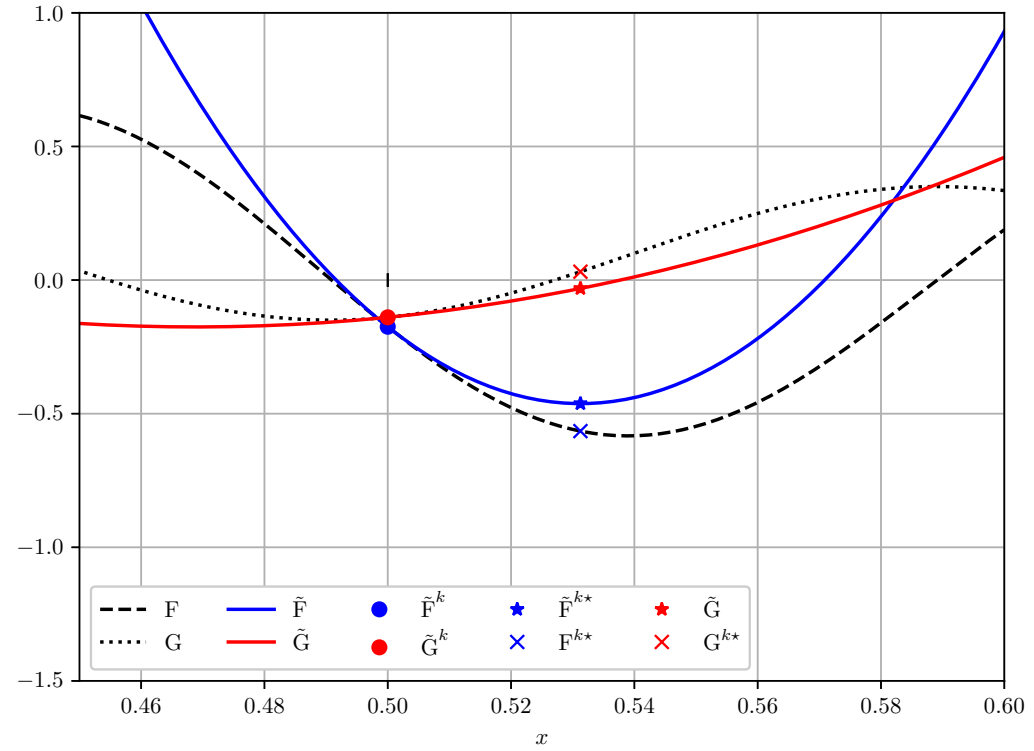
$$\alpha_G = 8.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.000$$

at the solution

$$x^{k*} = 0.531$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -4.623e - 01$$

$$\tilde{G}^{k*} = -3.145e - 02$$

while the actual functions are evaluated to be

$$F^{k*} = -5.652e - 01$$

$$G^{k*} = 3.121e - 02$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.500$$

$$F^k = -0.175$$

$$d_x^k F = -18.413$$

$$dd_x^k \tilde{F} = 73.650$$

$$\alpha_F = 8.000$$

$$G^k = -0.139$$

$$d_x^k G = 2.303$$

$$dd_x^k \tilde{G} = 9.213$$

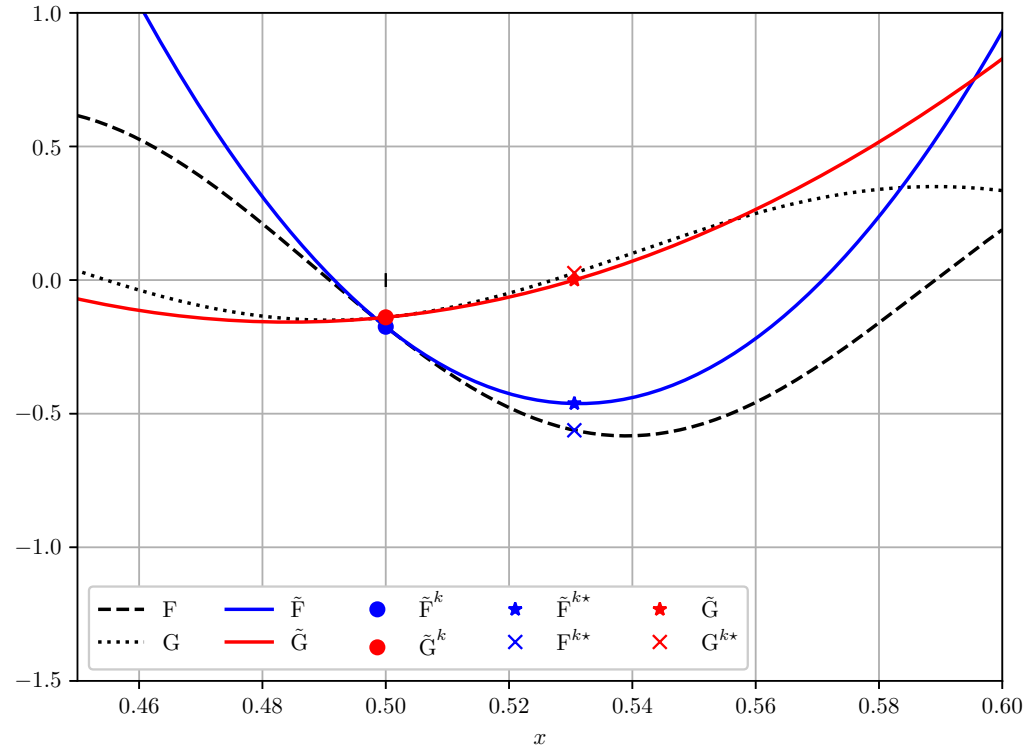
$$\alpha_G = 16.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.057$$

at the solution

$$x^{k*} = 0.531$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -4.622e - 01$$

$$\tilde{G}^{k*} = -3.387e - 12$$

while the actual functions are evaluated to be

$$F^{k*} = -5.620e - 01$$

$$G^{k*} = 2.614e - 02$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.500$$

$$F^k = -0.175$$

$$d_x^k F = -18.413$$

$$dd_x^k \tilde{F} = 73.650$$

$$\alpha_F = 8.000$$

$$G^k = -0.139$$

$$d_x^k G = 2.303$$

$$dd_x^k \tilde{G} = 9.213$$

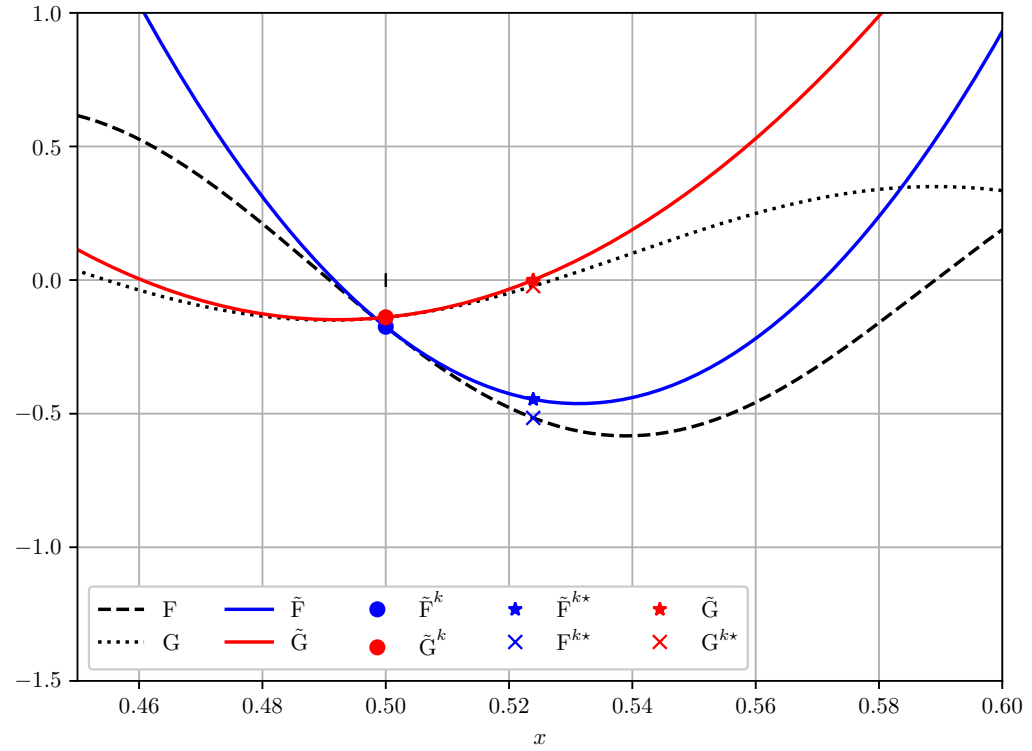
$$\alpha_G = 32.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.462$$

at the solution

$$x^{k*} = 0.524$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -4.465e - 01$$

$$\tilde{G}^{k*} = -6.761e - 11$$

while the actual functions are evaluated to be

$$F^{k*} = -5.159e - 01$$

$$G^{k*} = -2.278e - 02$$

Both the value objective function approximation and the constraint function approximation, at the new design point x^{k*} , is *conservative* with respect to the actual function values, $\tilde{F}^{k*} > F^{k*}$, $\tilde{G}^{k*} > G^{k*}$

QP subproblem at x^k :

$$x^k = 0.524$$

$$F^k = -0.516$$

$$d_x^k F = -8.791$$

$$dd_x^k \tilde{F} = 33.559$$

$$\alpha_F = 1.000$$

$$G^k = -0.023$$

$$d_x^k G = 6.969$$

$$dd_x^k \tilde{G} = 26.602$$

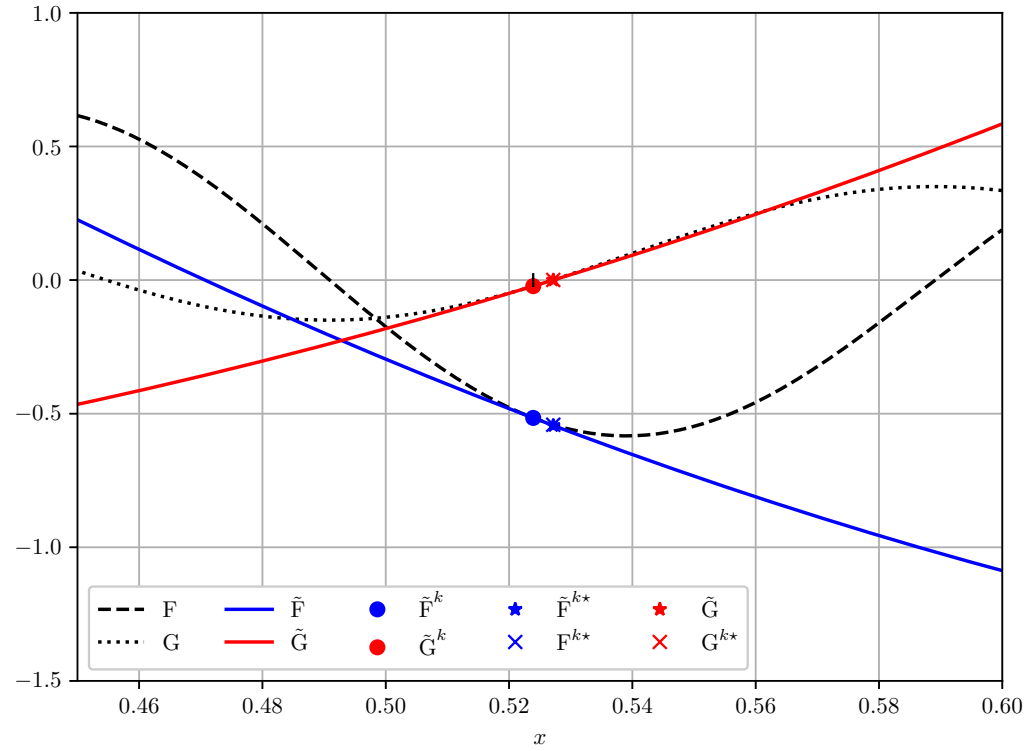
$$\alpha_G = 1.000$$

with Lagrange multiplier

$$\lambda^{k*} = 1.231$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.442e - 01$$

$$\tilde{G}^{k*} = -1.121e - 09$$

while the actual functions are evaluated to be

$$F^{k*} = -5.415e - 01$$

$$G^{k*} = 4.819e - 04$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.524$$

$$F^k = -0.516$$

$$d_x^k F = -8.791$$

$$dd_x^k \tilde{F} = 33.559$$

$$\alpha_F = 2.000$$

$$G^k = -0.023$$

$$d_x^k G = 6.969$$

$$dd_x^k \tilde{G} = 26.602$$

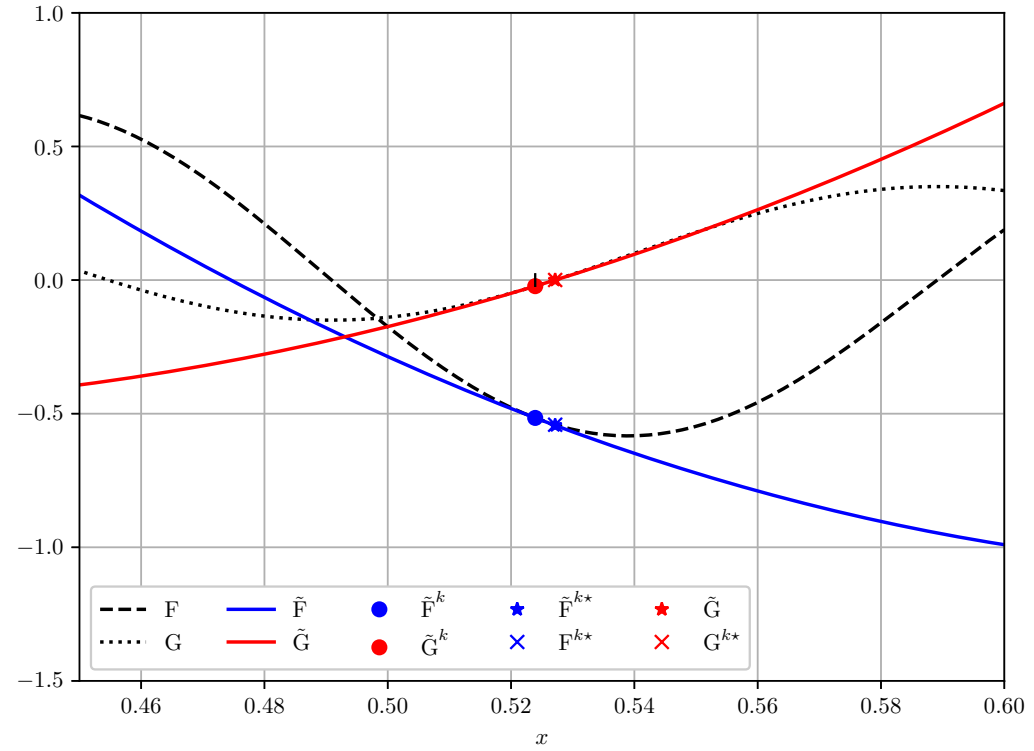
$$\alpha_G = 2.000$$

with Lagrange multiplier

$$\lambda^{k*} = 1.201$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.439e - 01$$

$$\tilde{G}^{k*} = 4.003e - 10$$

while the actual functions are evaluated to be

$$F^{k*} = -5.414e - 01$$

$$G^{k*} = 3.376e - 04$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.524$$

$$F^k = -0.516$$

$$d_x^k F = -8.791$$

$$dd_x^k \tilde{F} = 33.559$$

$$\alpha_F = 4.000$$

$$G^k = -0.023$$

$$d_x^k G = 6.969$$

$$dd_x^k \tilde{G} = 26.602$$

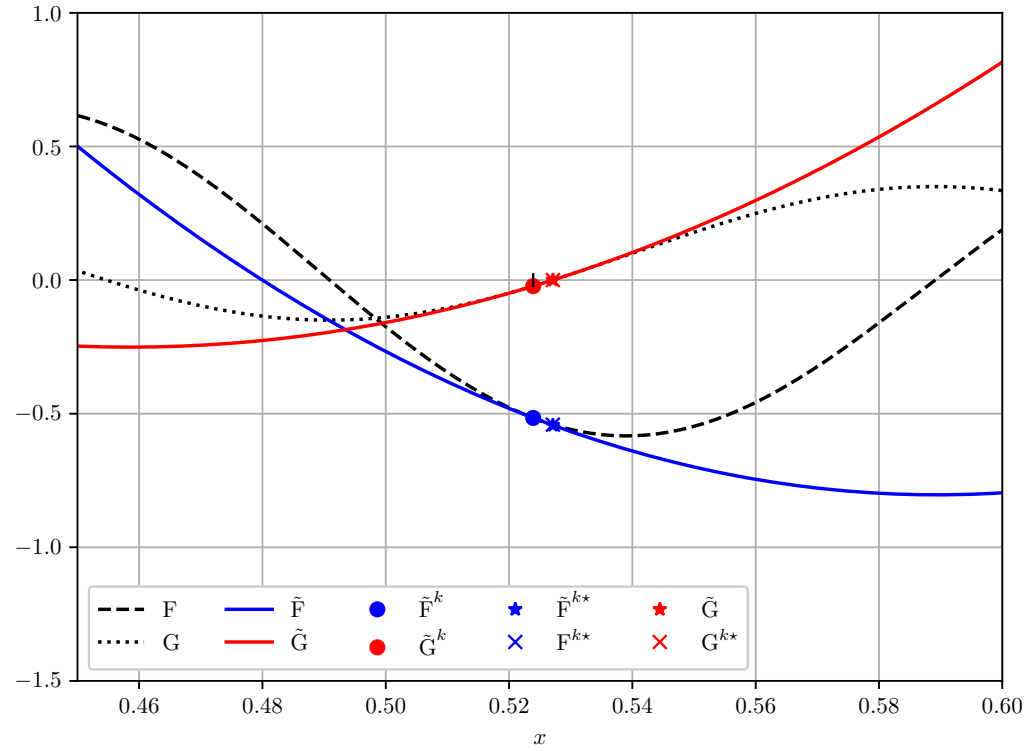
$$\alpha_G = 4.000$$

with Lagrange multiplier

$$\lambda^{k*} = 1.144$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.432e - 01$$

$$\tilde{G}^{k*} = 5.598e - 11$$

while the actual functions are evaluated to be

$$F^{k*} = -5.411e - 01$$

$$G^{k*} = 5.920e - 05$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.524$$

$$F^k = -0.516$$

$$d_x^k F = -8.791$$

$$dd_x^k \tilde{F} = 33.559$$

$$\alpha_F = 8.000$$

$$G^k = -0.023$$

$$d_x^k G = 6.969$$

$$dd_x^k \tilde{G} = 26.602$$

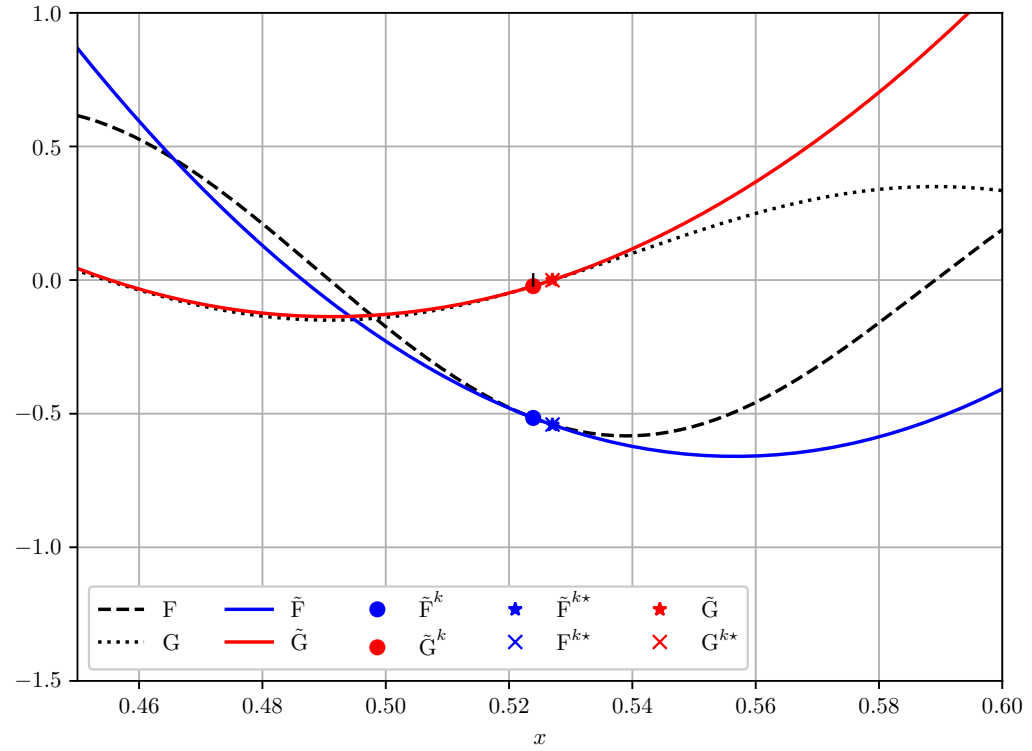
$$\alpha_G = 8.000$$

with Lagrange multiplier

$$\lambda^{k*} = 1.042$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.420e - 01$$

$$\tilde{G}^{k*} = 1.244e - 14$$

while the actual functions are evaluated to be

$$F^{k*} = -5.406e - 01$$

$$G^{k*} = -4.607e - 04$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.524$$

$$F^k = -0.516$$

$$d_x^k F = -8.791$$

$$dd_x^k \tilde{F} = 33.559$$

$$\alpha_F = 16.000$$

$$G^k = -0.023$$

$$d_x^k G = 6.969$$

$$dd_x^k \tilde{G} = 26.602$$

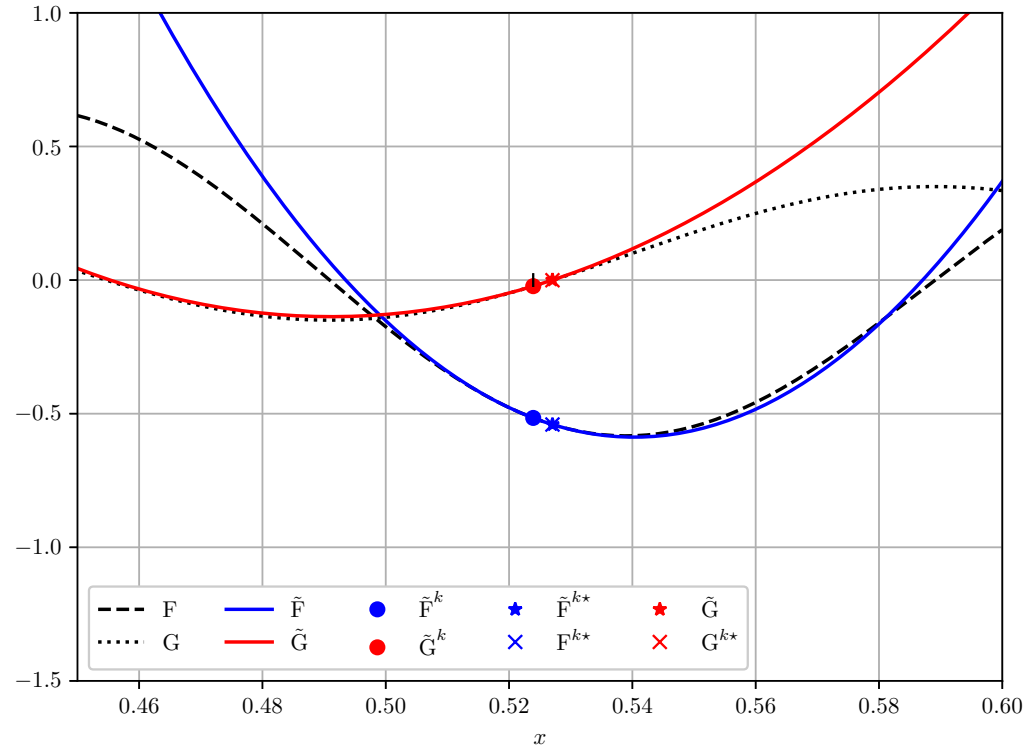
$$\alpha_G = 8.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.932$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.407e - 01$$

$$\tilde{G}^{k*} = -8.518e - 11$$

while the actual functions are evaluated to be

$$F^{k*} = -5.406e - 01$$

$$G^{k*} = -4.607e - 04$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.524$$

$$F^k = -0.516$$

$$d_x^k F = -8.791$$

$$dd_x^k \tilde{F} = 33.559$$

$$\alpha_F = 32.000$$

$$G^k = -0.023$$

$$d_x^k G = 6.969$$

$$dd_x^k \tilde{G} = 26.602$$

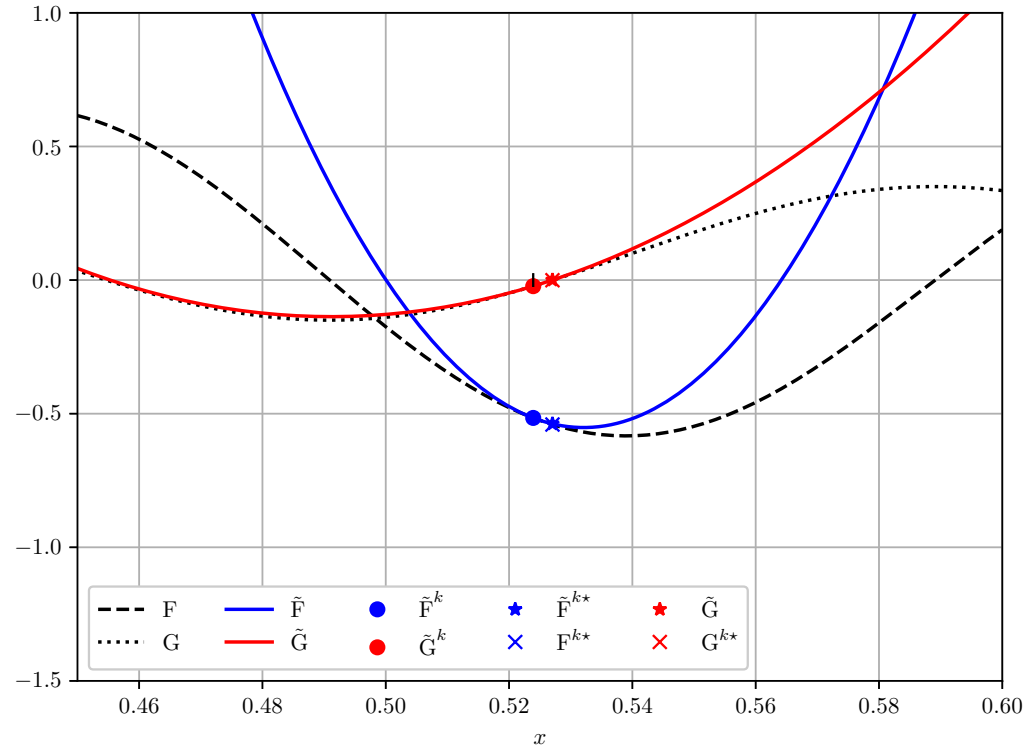
$$\alpha_G = 8.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.713$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.381e - 01$$

$$\tilde{G}^{k*} = -2.964e - 11$$

while the actual functions are evaluated to be

$$F^{k*} = -5.406e - 01$$

$$G^{k*} = -4.607e - 04$$

Both the value objective function approximation and the constraint function approximation, at the new design point x^{k*} , is *conservative* with respect to the actual function values, $\tilde{F}^{k*} > F^{k*}$, $\tilde{G}^{k*} > G^{k*}$

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.051$$

$$dd_x^k \tilde{F} = 26.756$$

$$\alpha_F = 1.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.326$$

$$dd_x^k \tilde{G} = 27.799$$

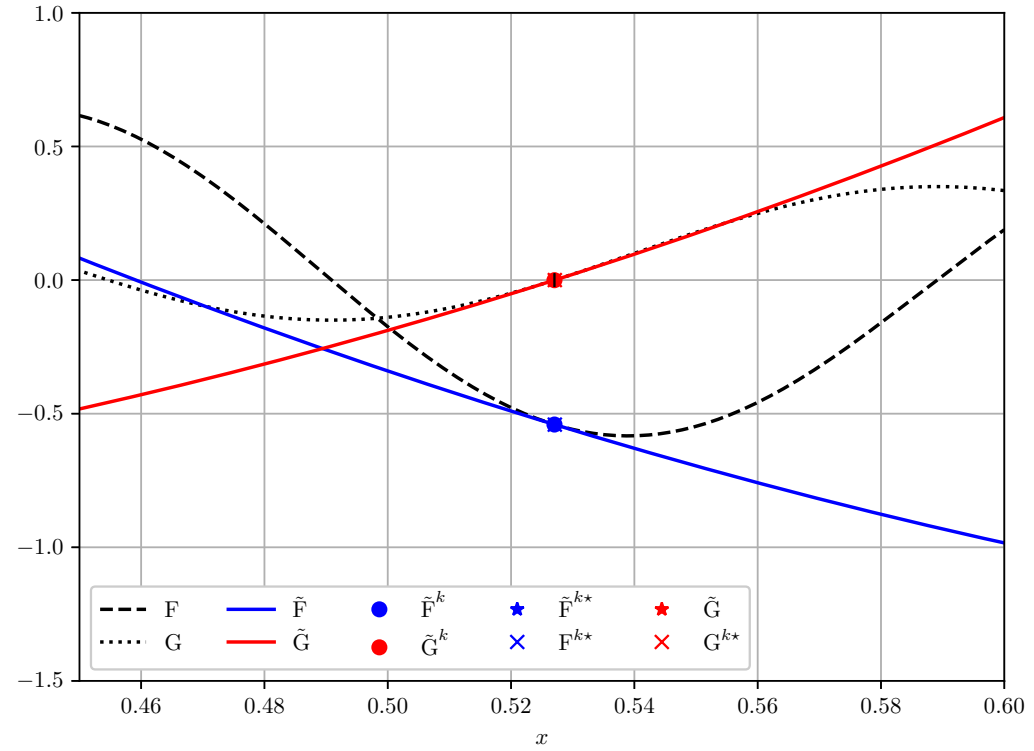
$$\alpha_G = 1.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.962$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = -3.223e - 10$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = 1.478e - 07$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.051$$

$$dd_x^k \tilde{F} = 26.756$$

$$\alpha_F = 2.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.326$$

$$dd_x^k \tilde{G} = 27.799$$

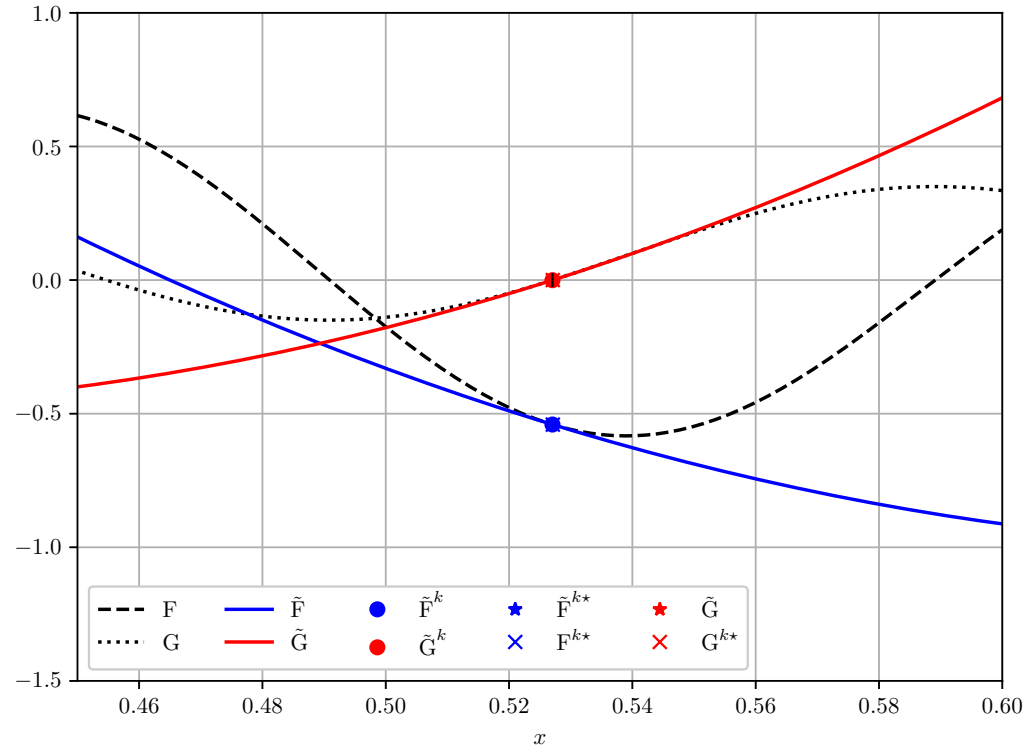
$$\alpha_G = 2.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.962$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = -2.785e - 11$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = 9.308e - 08$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.051$$

$$dd_x^k \tilde{F} = 26.756$$

$$\alpha_F = 4.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.326$$

$$dd_x^k \tilde{G} = 27.799$$

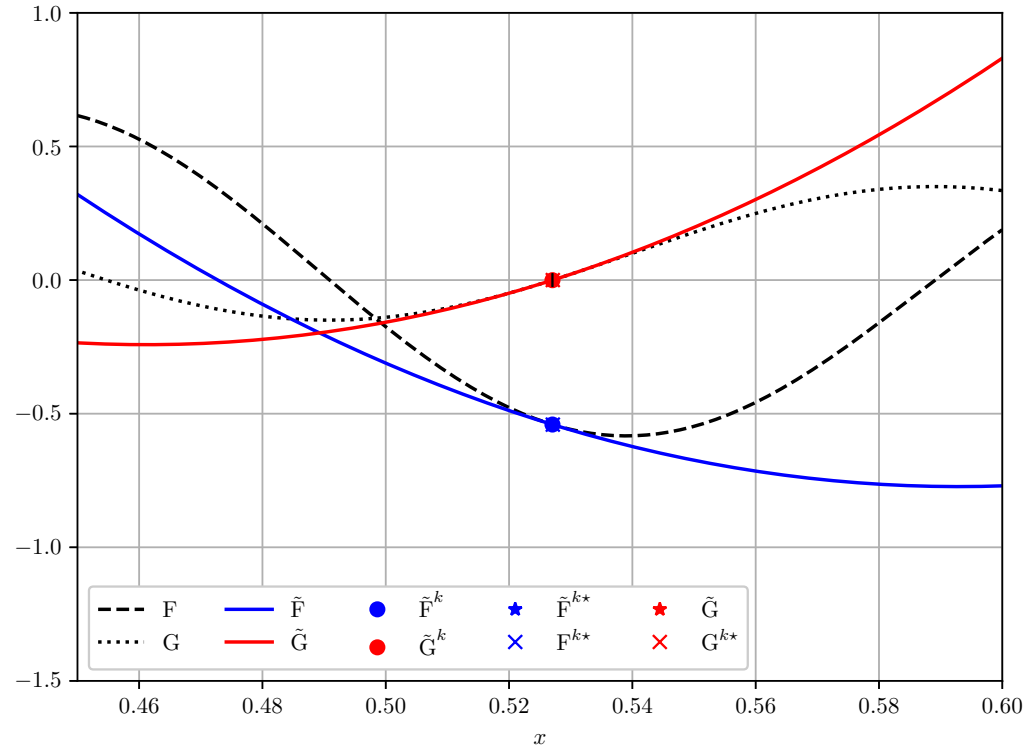
$$\alpha_G = 4.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.961$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = -2.735e - 10$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = -1.703e - 08$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.051$$

$$dd_x^k \tilde{F} = 26.756$$

$$\alpha_F = 8.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.326$$

$$dd_x^k \tilde{G} = 27.799$$

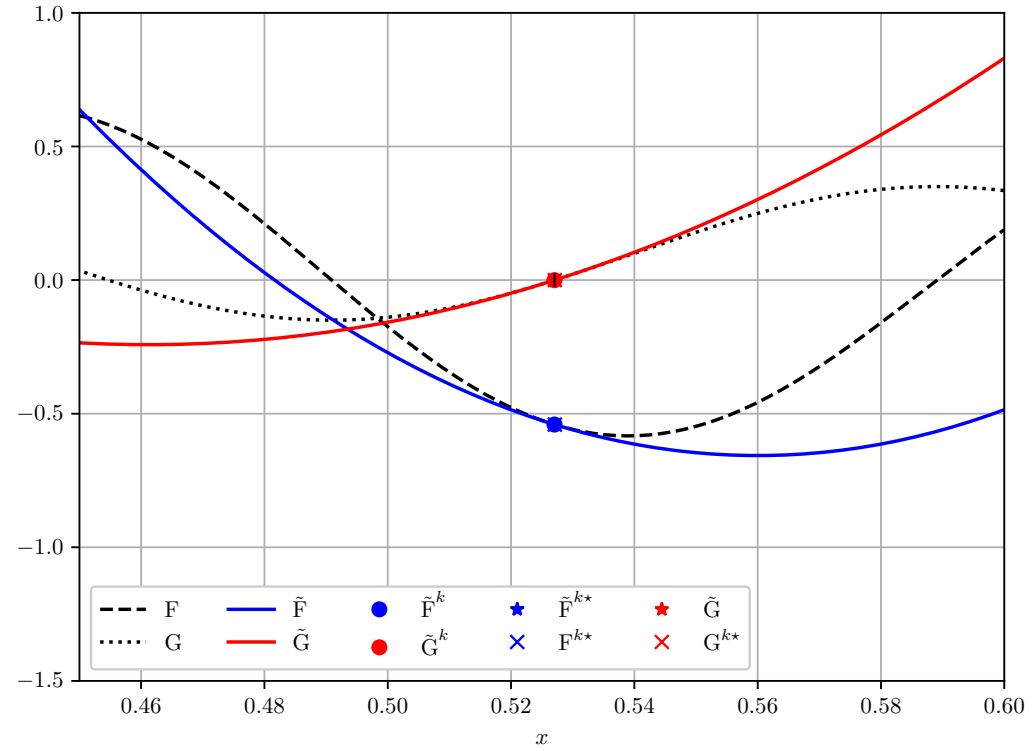
$$\alpha_G = 4.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.960$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = 1.634e - 10$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = -1.659e - 08$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.051$$

$$dd_x^k \tilde{F} = 26.756$$

$$\alpha_F = 16.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.326$$

$$dd_x^k \tilde{G} = 27.799$$

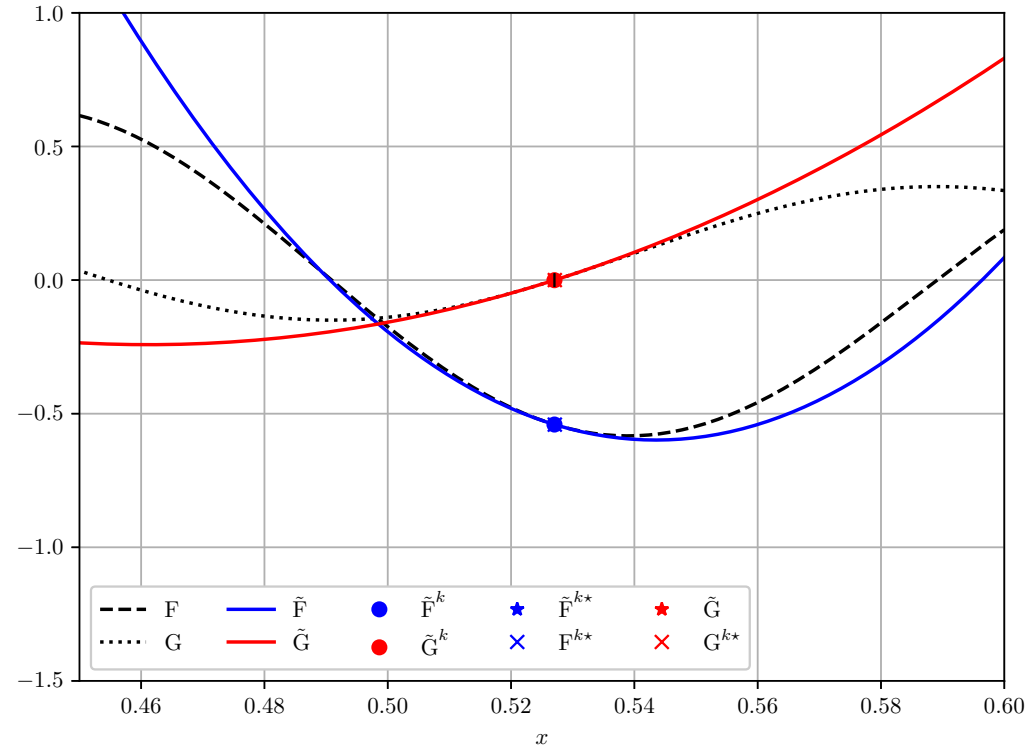
$$\alpha_G = 4.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.958$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = 1.639e - 10$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = -1.659e - 08$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.051$$

$$dd_x^k \tilde{F} = 26.756$$

$$\alpha_F = 32.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.326$$

$$dd_x^k \tilde{G} = 27.799$$

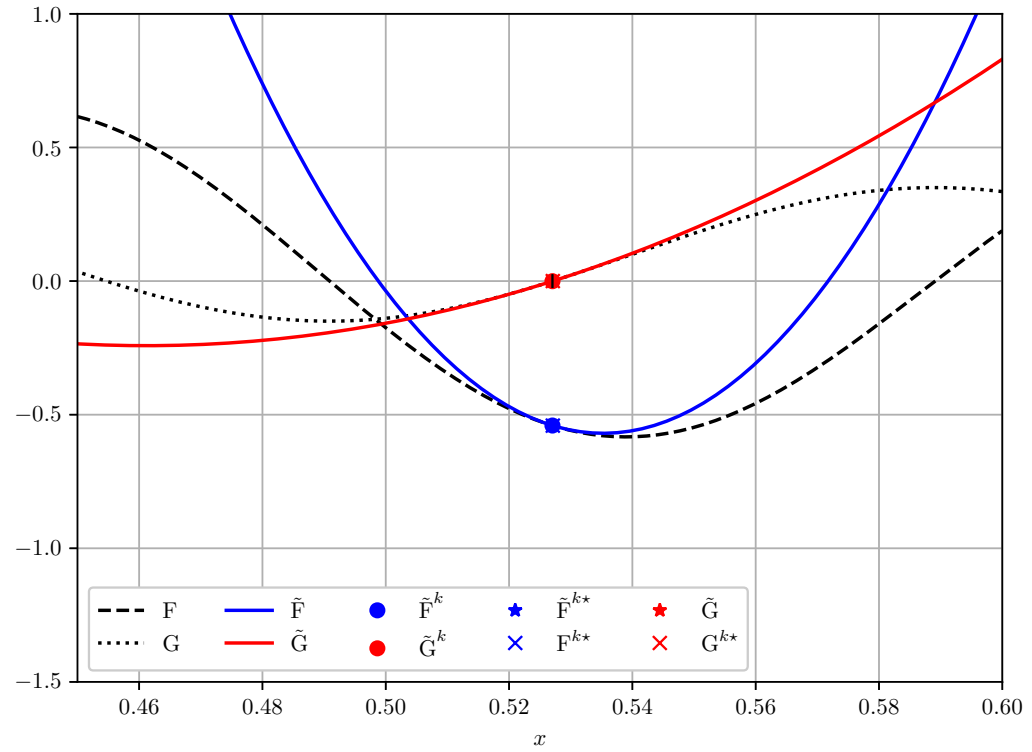
$$\alpha_G = 4.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.954$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = -2.957e - 11$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = -1.679e - 08$$

Both the value objective function approximation and the constraint function approximation, at the new design point x^{k*} , is *conservative* with respect to the actual function values, $\tilde{F}^{k*} > F^{k*}$, $\tilde{G}^{k*} > G^{k*}$

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.015$$

$$dd_x^k \tilde{F} = 26.617$$

$$\alpha_F = 1.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.332$$

$$dd_x^k \tilde{G} = 27.821$$

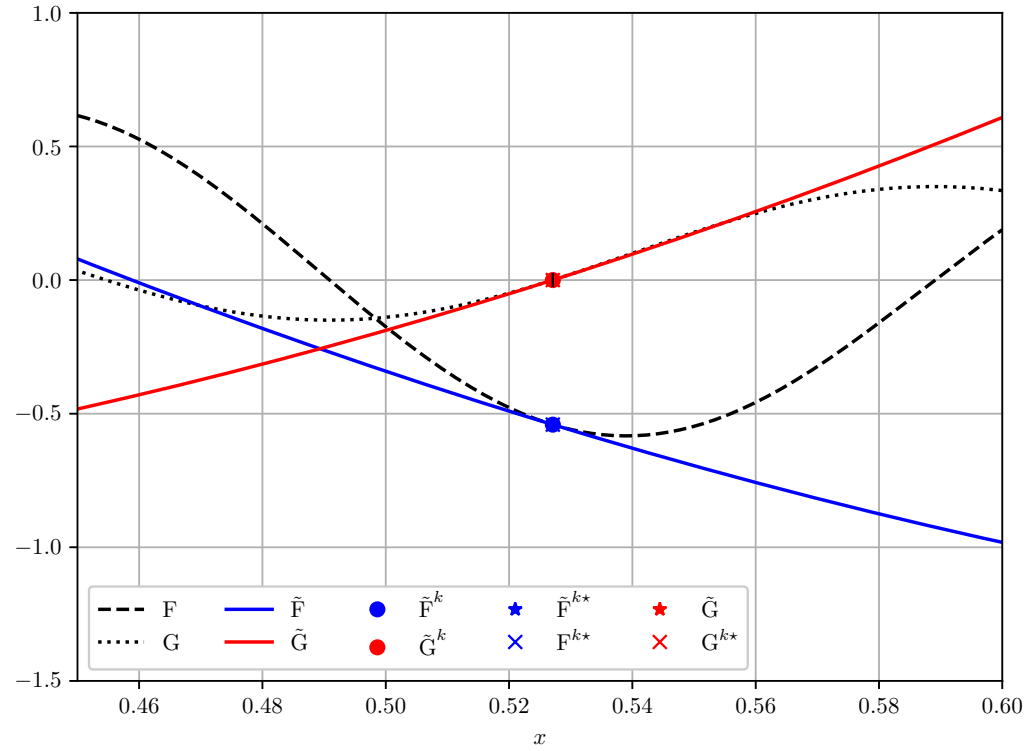
$$\alpha_G = 1.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.957$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = -1.070e - 09$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = -1.070e - 09$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.015$$

$$dd_x^k \tilde{F} = 26.617$$

$$\alpha_F = 2.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.332$$

$$dd_x^k \tilde{G} = 27.821$$

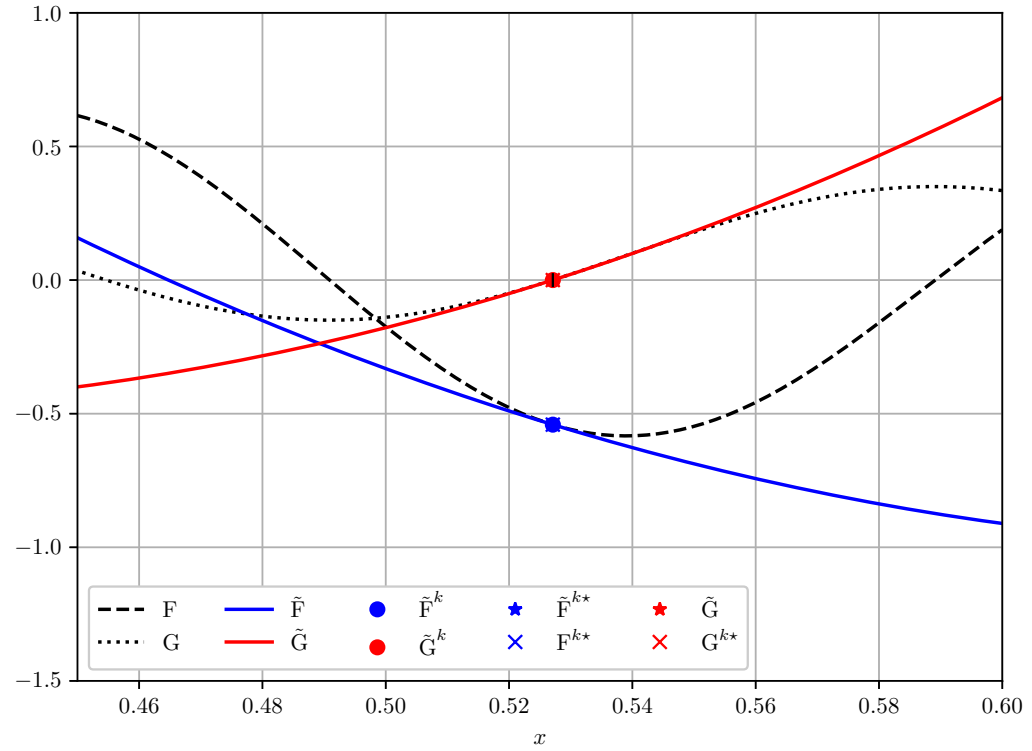
$$\alpha_G = 2.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.957$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = -1.687e - 10$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = -1.687e - 10$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

→ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{G}^{k*} < G^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.015$$

$$dd_x^k \tilde{F} = 26.617$$

$$\alpha_F = 4.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.332$$

$$dd_x^k \tilde{G} = 27.821$$

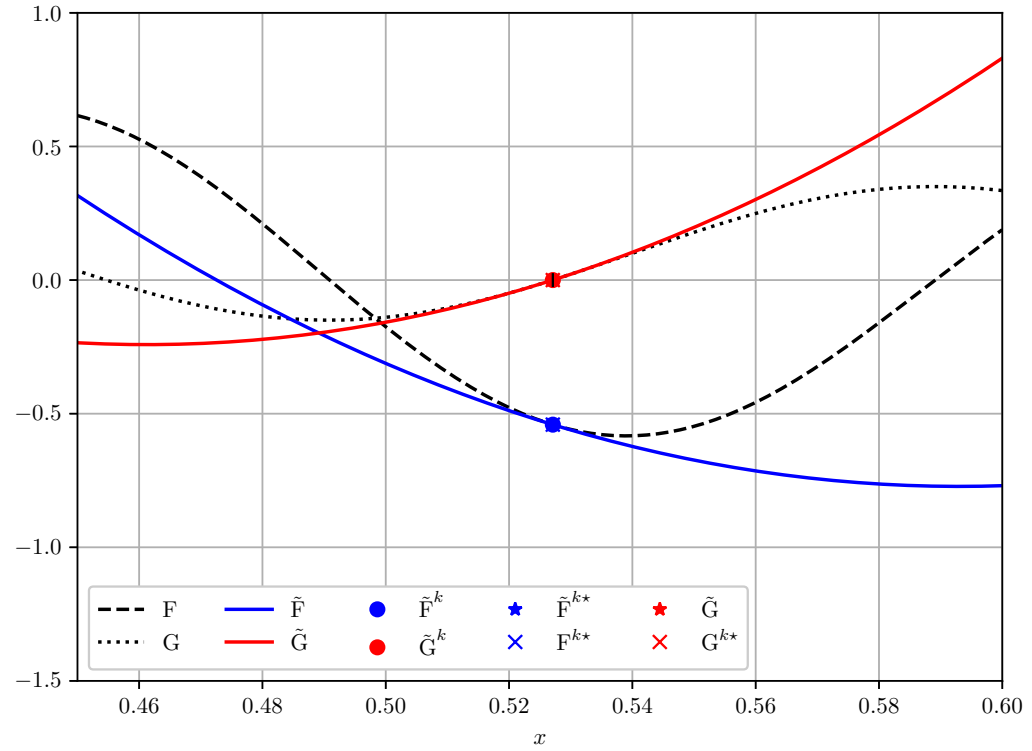
$$\alpha_G = 4.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.957$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = 2.822e - 10$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = 2.822e - 10$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.015$$

$$dd_x^k \tilde{F} = 26.617$$

$$\alpha_F = 8.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.332$$

$$dd_x^k \tilde{G} = 27.821$$

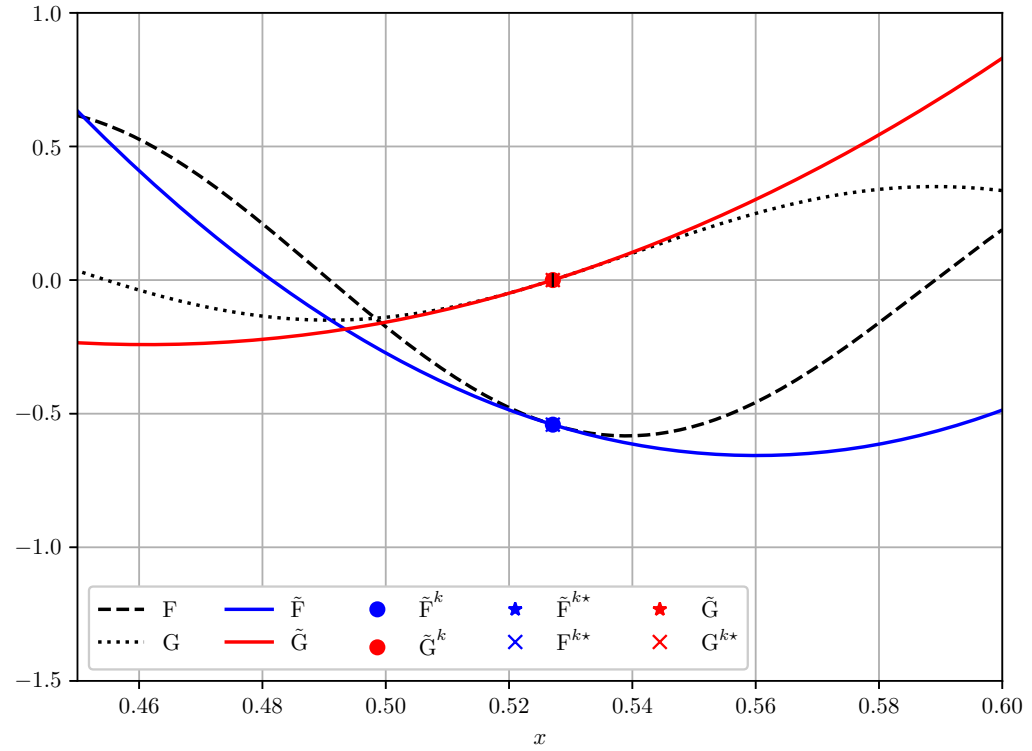
$$\alpha_G = 4.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.957$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = -1.515e - 10$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = -1.515e - 10$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.015$$

$$dd_x^k \tilde{F} = 26.617$$

$$\alpha_F = 16.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.332$$

$$dd_x^k \tilde{G} = 27.821$$

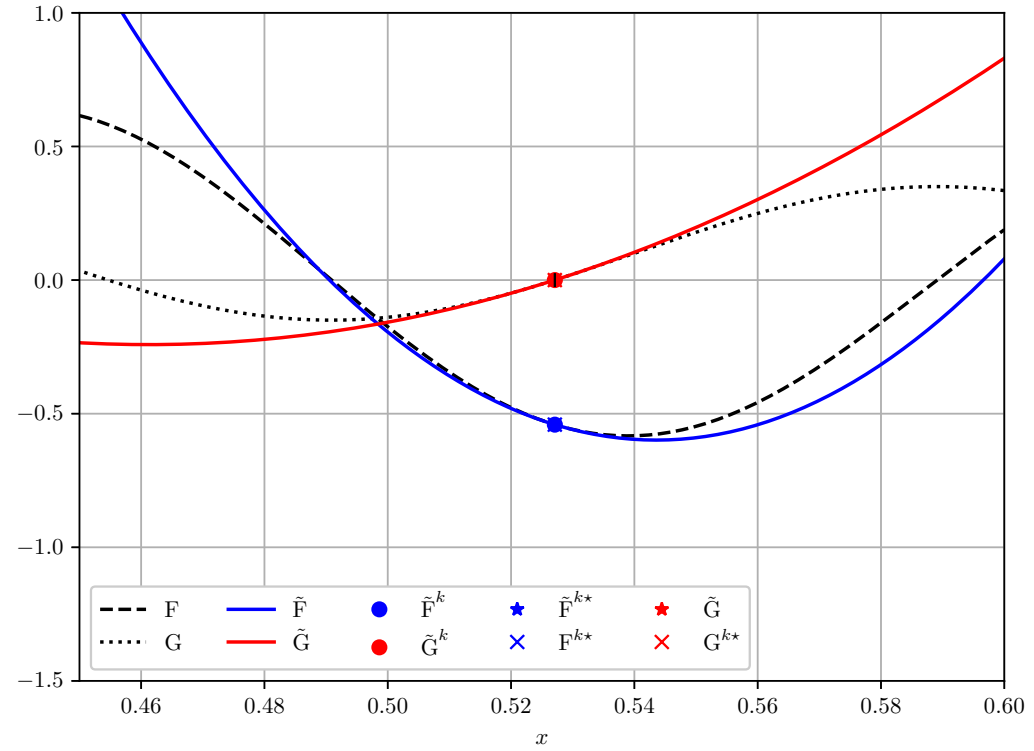
$$\alpha_G = 4.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.957$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = -1.481e - 10$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = -1.481e - 10$$

However, the solution (step) is deemed *unacceptable*, because

→ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{F}^{k*} < F^{k*}$.

That is, at least one approximation function is not *conservative*.

QP subproblem at x^k :

$$x^k = 0.527$$

$$F^k = -0.541$$

$$d_x^k F = -7.015$$

$$dd_x^k \tilde{F} = 26.617$$

$$\alpha_F = 32.000$$

$$G^k = -0.000$$

$$d_x^k G = 7.332$$

$$dd_x^k \tilde{G} = 27.821$$

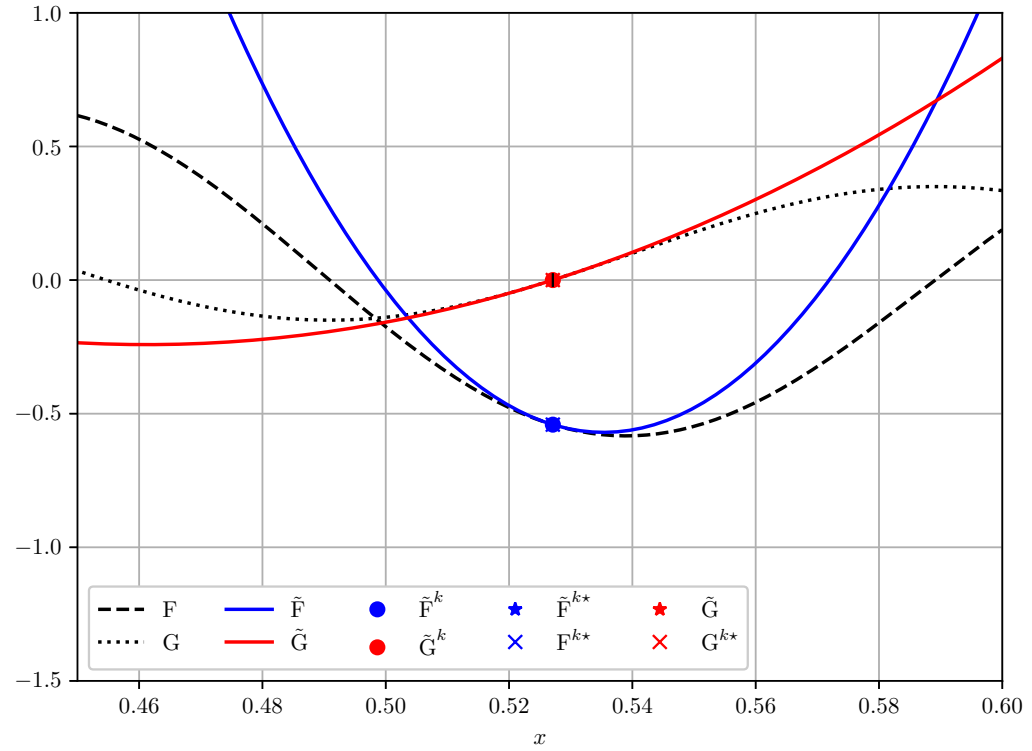
$$\alpha_G = 4.000$$

with Lagrange multiplier

$$\lambda^{k*} = 0.957$$

at the solution

$$x^{k*} = 0.527$$



At the solution of the QP the function approximations have the values

$$\tilde{F}^{k*} = -5.410e - 01$$

$$\tilde{G}^{k*} = 4.889e - 11$$

while the actual functions are evaluated to be

$$F^{k*} = -5.410e - 01$$

$$G^{k*} = 4.889e - 11$$

Both the value objective function approximation and the constraint function approximation, at the new design point x^{k*} , is *conservative* with respect to the actual function values, $\tilde{F}^{k*} > F^{k*}$, $\tilde{G}^{k*} > G^{k*}$

Terminated on $|x^{k*} - x^k| < 1e-6$

Python code