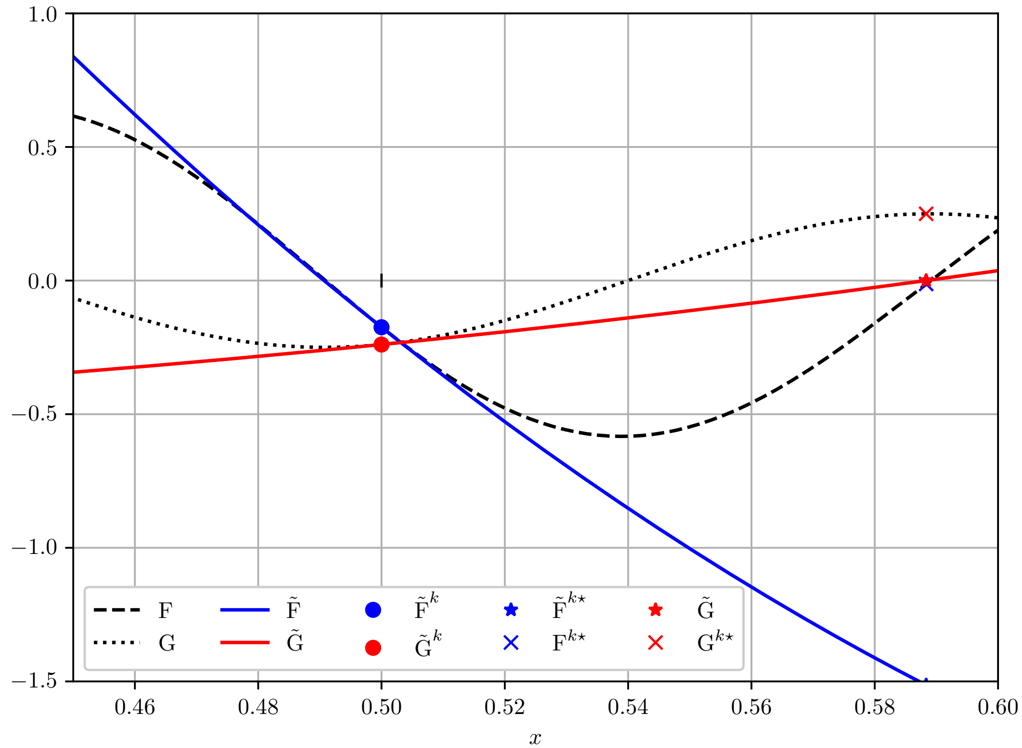
Svanberg's (strict) conservatism

QP subproblem at x^k:

$x^k = 0.500$
$\mathrm{F}^k = -0.175$
$\mathrm{d}_x^k\mathrm{F} = -18.413$
$\mathrm{dd}_x^k\mathrm{F} = 73.650$
$\alpha_\mathrm{F} = 1.000$

$\mathrm{G}^k = -0.239$
$\mathrm{d}_x^k\mathrm{G} = 2.303$
$\mathrm{dd}_x^k\mathrm{G} = 9.213$
$\alpha_\mathrm{G} = 1.000$

with Lagrange multiplier
$\lambda^{k\star} = 3.820$
at the solution
$x^{k\star} = 0.588$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -1.514$
$\tilde{\mathrm{G}}^{k\star} = -0.000$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.013$
$\mathrm{G}^{k\star} = 0.250$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.
$\rightarrow$ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{G}}^{k\star} < \mathrm{G}^{k\star}$.

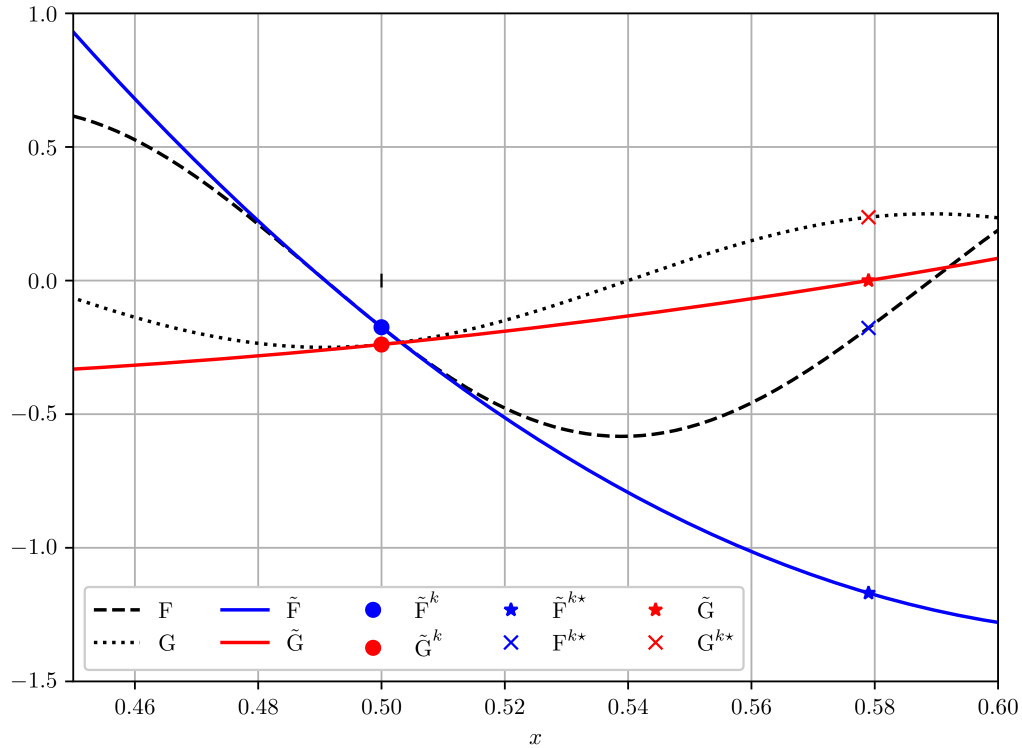
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.500$
$\mathrm{F}^k = -0.175$
$\mathrm{d}_x^k\mathrm{F} = -18.413$
$\mathrm{dd}_x^k\mathrm{F} = 73.650$
$\alpha_\mathrm{F} = 2.000$

$\mathrm{G}^k = -0.239$
$\mathrm{d}_x^k\mathrm{G} = 2.303$
$\mathrm{dd}_x^k\mathrm{G} = 9.213$
$\alpha_\mathrm{G} = 2.000$

with Lagrange multiplier
$\lambda^{k\star} = 1.803$
at the solution
$x^{k\star} = 0.579$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -1.169$
$\tilde{\mathrm{G}}^{k\star} = 0.000$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.177$
$\mathrm{G}^{k\star} = 0.237$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.
$\rightarrow$ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{G}}^{k\star} < \mathrm{G}^{k\star}$.

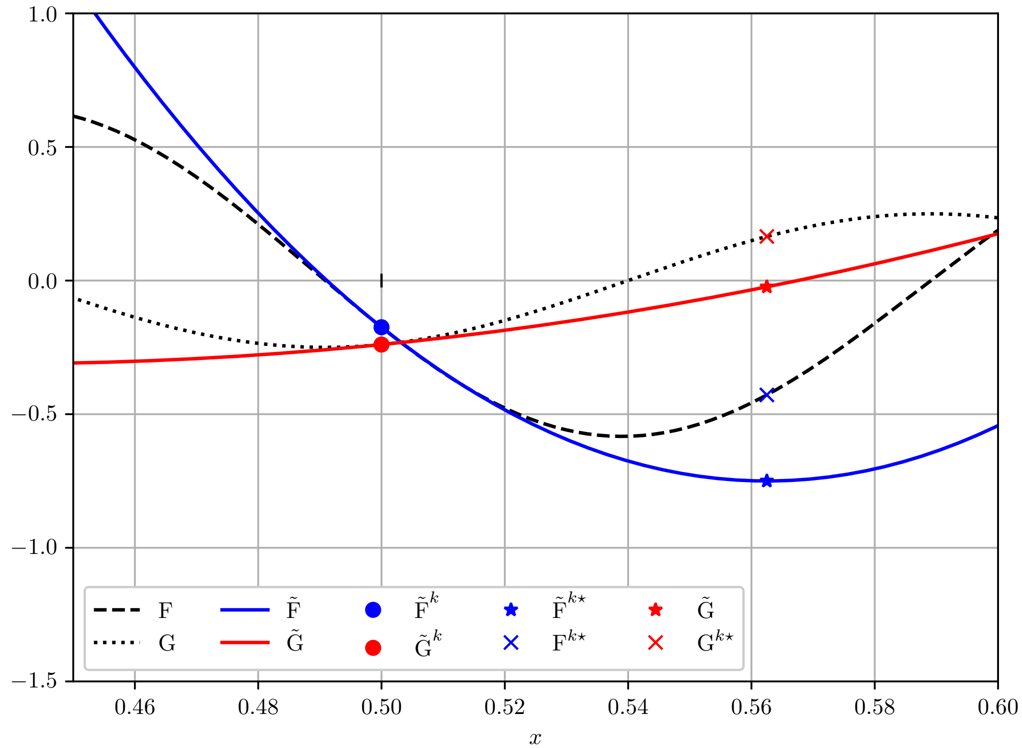
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.500$
$\mathrm{F}^k = -0.175$
$\mathrm{d}_x^k\mathrm{F} = -18.413$
$\mathrm{dd}_x^k\mathrm{F} = 73.650$
$\alpha_\mathrm{F} = 4.000$

$\mathrm{G}^k = -0.239$
$\mathrm{d}_x^k\mathrm{G} = 2.303$
$\mathrm{dd}_x^k\mathrm{G} = 9.213$
$\alpha_\mathrm{G} = 4.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.000$
at the solution
$x^{k\star} = 0.562$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.750$
$\tilde{\mathrm{G}}^{k\star} = -0.023$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.428$
$\mathrm{G}^{k\star} = 0.165$

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

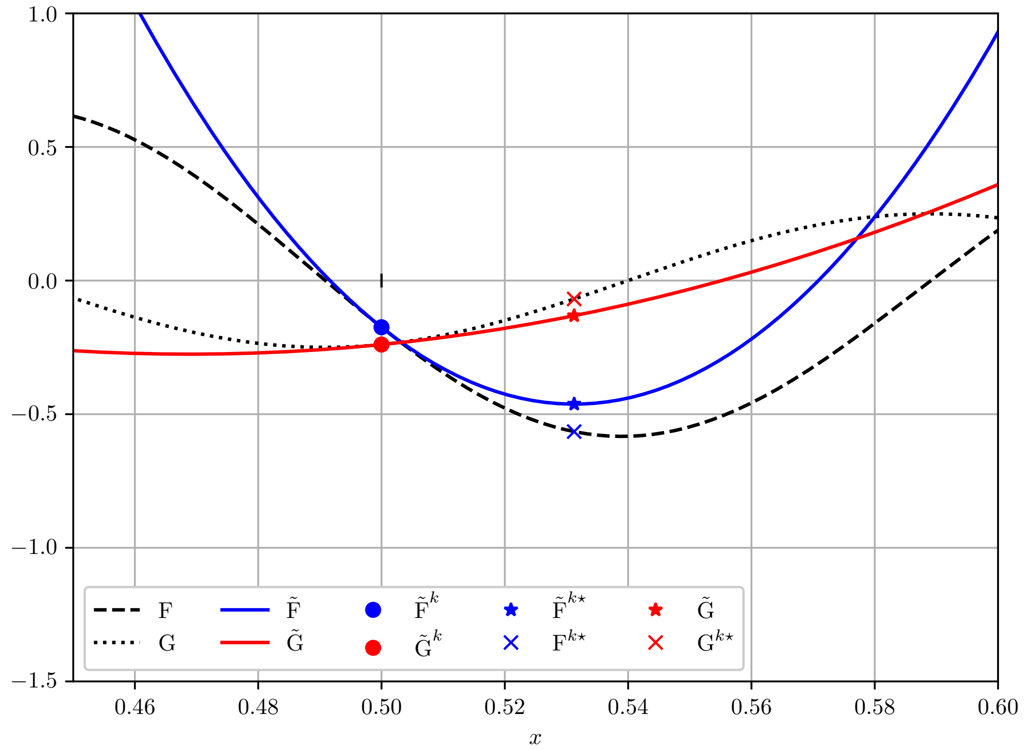
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.500$
$\mathrm{F}^k = -0.175$
$\mathrm{d}_x^k\mathrm{F} = -18.413$
$\mathrm{dd}_x^k\mathrm{F} = 73.650$
$\alpha_\mathrm{F} = 8.000$

$\mathrm{G}^k = -0.239$
$\mathrm{d}_x^k\mathrm{G} = 2.303$
$\mathrm{dd}_x^k\mathrm{G} = 9.213$
$\alpha_\mathrm{G} = 8.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.000$
at the solution
$x^{k\star} = 0.531$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.462$
$\tilde{\mathrm{G}}^{k\star} = -0.131$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.565$
$\mathrm{G}^{k\star} = -0.069$

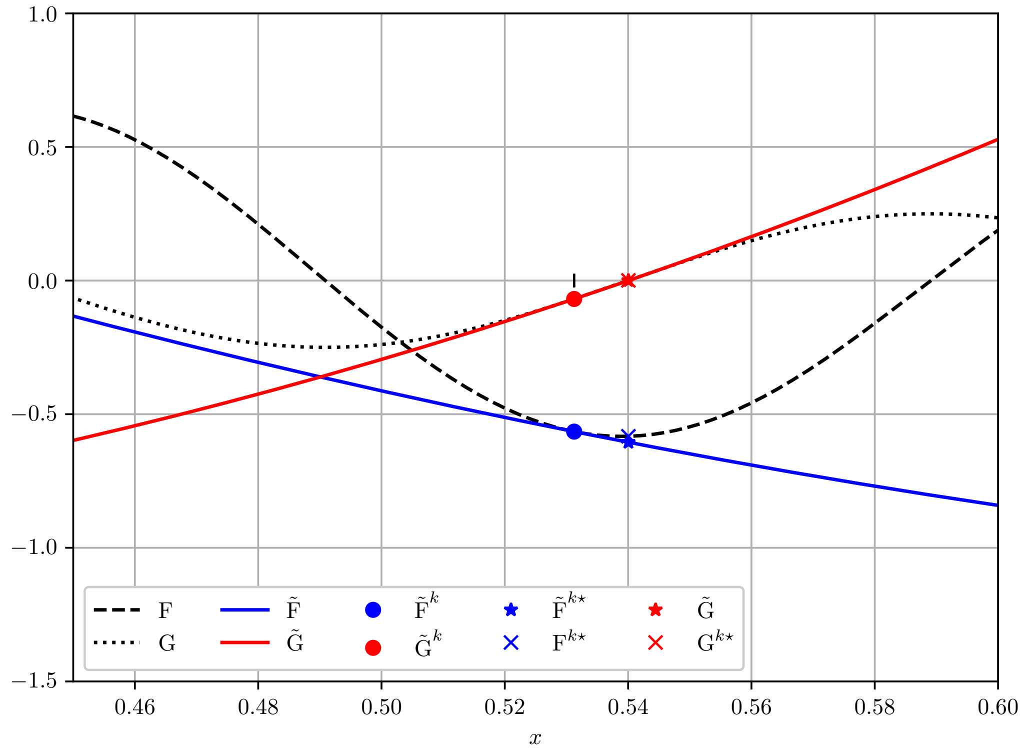
The solution leads to a feasible descent step and is therefore deemed *acceptable*, as is.
(Note that the objective and/or constraint function approximation is not conservative in this case.)

QP subproblem at x^k:

$x^k = 0.531$
$\mathrm{F}^k = -0.565$
$\mathrm{d}_x^k\mathrm{F} = -4.611$
$\mathrm{dd}_x^k\mathrm{F} = 17.360$
$\alpha_\mathrm{F} = 1.000$

$\mathrm{G}^k = -0.069$
$\mathrm{d}_x^k\mathrm{G} = 7.691$
$\mathrm{dd}_x^k\mathrm{G} = 28.955$
$\alpha_\mathrm{G} = 1.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.561$
at the solution
$x^{k\star} = 0.540$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.605$
$\tilde{\mathrm{G}}^{k\star} = 0.000$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.583$
$\mathrm{G}^{k\star} = 0.001$

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

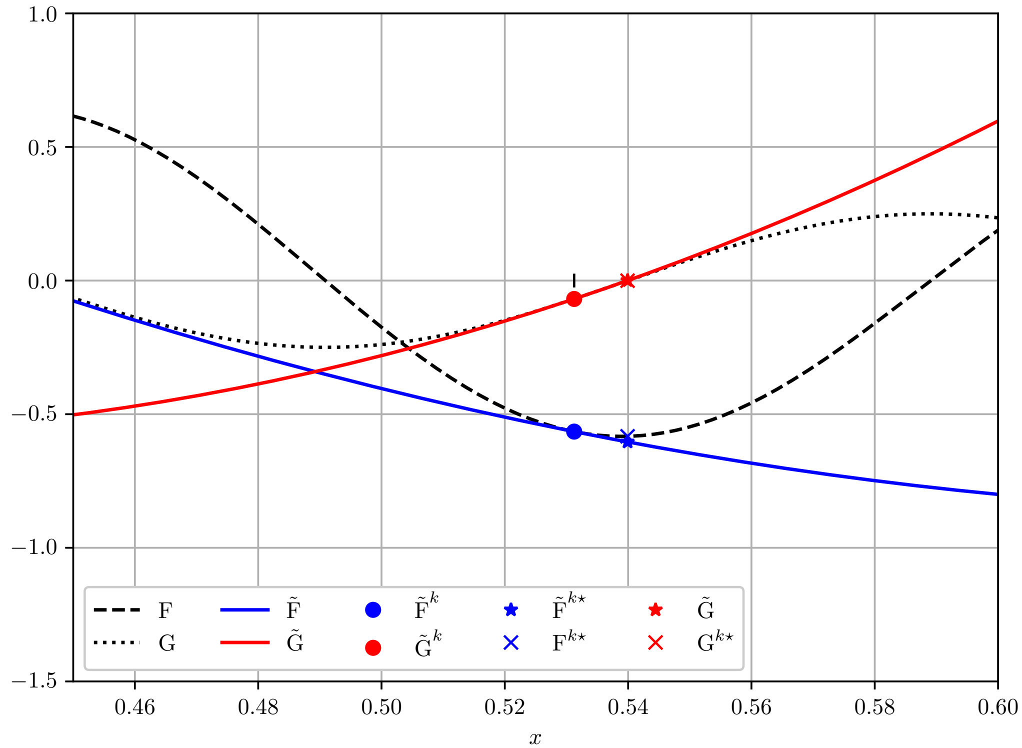
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.531$
$\mathrm{F}^k = -0.565$
$\mathrm{d}_x^k\mathrm{F} = -4.611$
$\mathrm{dd}_x^k\mathrm{F} = 17.360$
$\alpha_\mathrm{F} = 2.000$

$\mathrm{G}^k = -0.069$
$\mathrm{d}_x^k\mathrm{G} = 7.691$
$\mathrm{dd}_x^k\mathrm{G} = 28.955$
$\alpha_\mathrm{G} = 2.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.526$
at the solution
$x^{k\star} = 0.540$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.604$
$\tilde{\mathrm{G}}^{k\star} = 0.000$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.583$
$\mathrm{G}^{k\star} = -0.000$

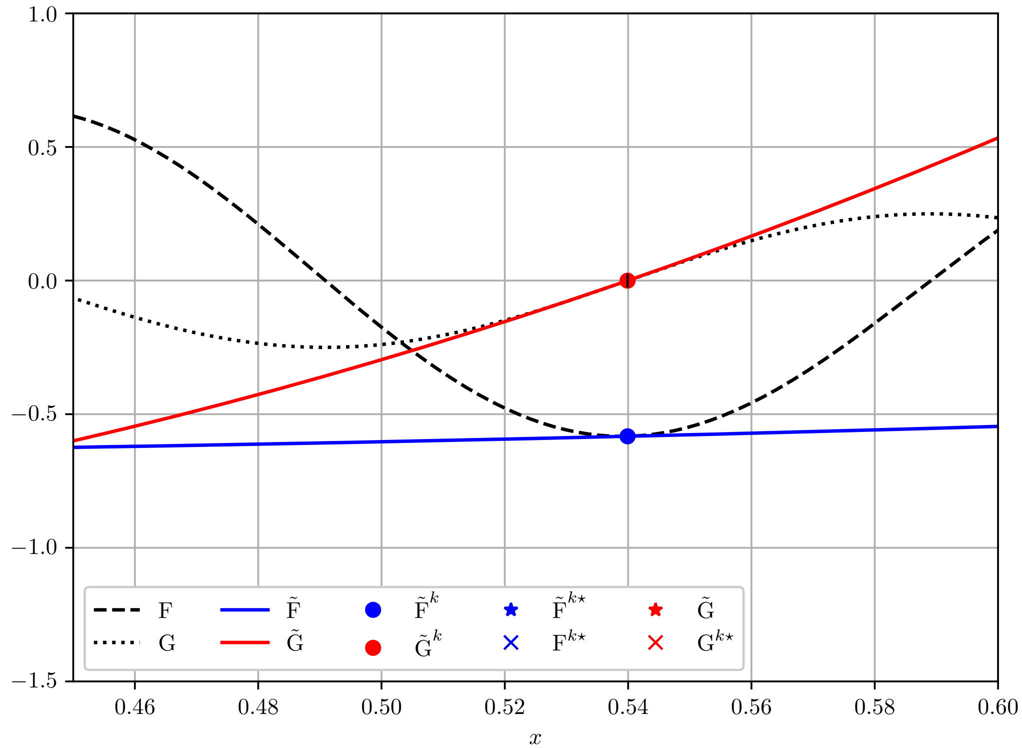
The solution leads to a feasible descent step and is therefore deemed *acceptable*, as is.
(Note that the objective and/or constraint function approximation is not conservative in this case.)

QP subproblem at x^k:

$x^k = 0.540$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = 0.553$
$\mathrm{dd}_x^k\mathrm{F} = 2.049$
$\alpha_\mathrm{F} = 1.000$

$\mathrm{G}^k = -0.000$
$\mathrm{d}_x^k\mathrm{G} = 8.000$
$\mathrm{dd}_x^k\mathrm{G} = 29.634$
$\alpha_\mathrm{G} = 1.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.000$
at the solution
$x^{k\star} = 0.440$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.628$
$\tilde{\mathrm{G}}^{k\star} = -0.652$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = 0.643$
$\mathrm{G}^{k\star} = 0.015$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.
$\rightarrow$ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{G}}^{k\star} < \mathrm{G}^{k\star}$.

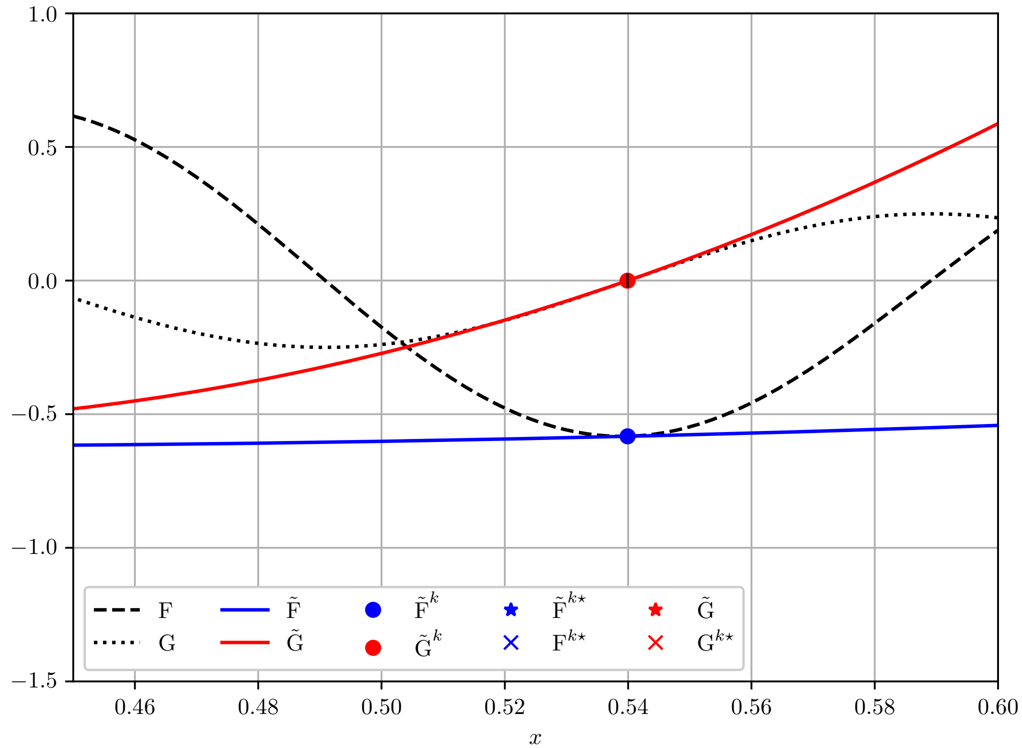
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.540$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = 0.553$
$\mathrm{dd}_x^k\mathrm{F} = 2.049$
$\alpha_\mathrm{F} = 2.000$

$\mathrm{G}^k = -0.000$
$\mathrm{d}_x^k\mathrm{G} = 8.000$
$\mathrm{dd}_x^k\mathrm{G} = 29.634$
$\alpha_\mathrm{G} = 2.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.000$
at the solution
$x^{k\star} = 0.440$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.618$
$\tilde{\mathrm{G}}^{k\star} = -0.504$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = 0.643$
$\mathrm{G}^{k\star} = 0.015$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.
$\rightarrow$ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{G}}^{k\star} < \mathrm{G}^{k\star}$.

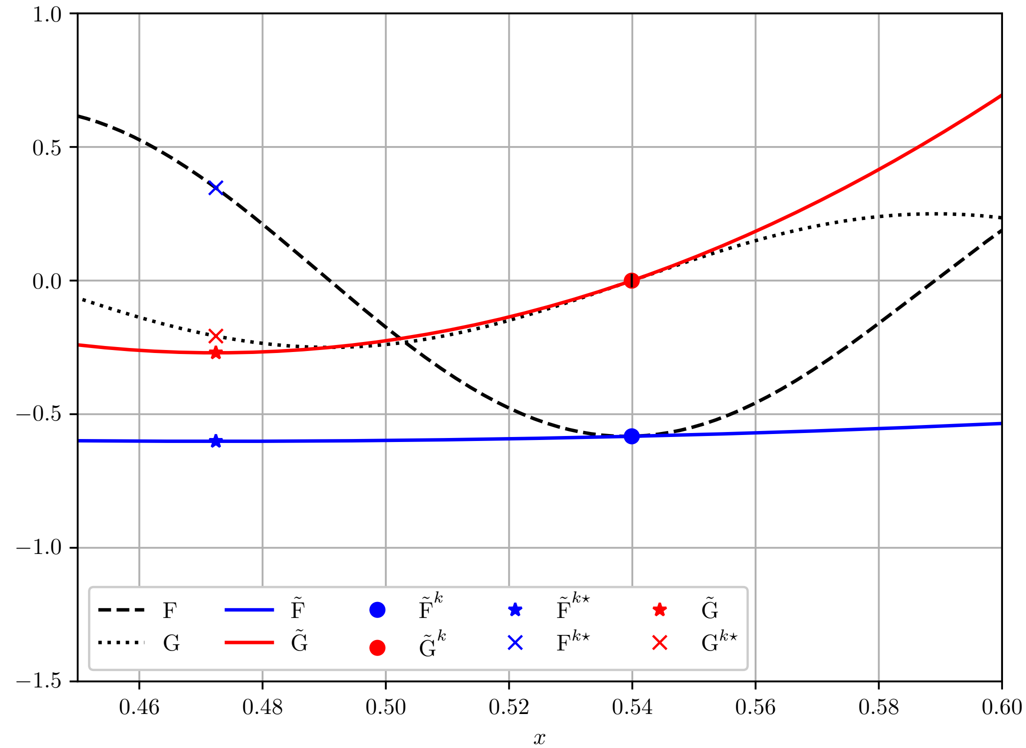
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.540$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = 0.553$
$\mathrm{dd}_x^k\mathrm{F} = 2.049$
$\alpha_\mathrm{F} = 4.000$

$\mathrm{G}^k = -0.000$
$\mathrm{d}_x^k\mathrm{G} = 8.000$
$\mathrm{dd}_x^k\mathrm{G} = 29.634$
$\alpha_\mathrm{G} = 4.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.000$
at the solution
$x^{k\star} = 0.472$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.601$
$\tilde{\mathrm{G}}^{k\star} = -0.270$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = 0.347$
$\mathrm{G}^{k\star} = -0.208$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.
$\rightarrow$ the value of the constraint function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{G}}^{k\star} < \mathrm{G}^{k\star}$.

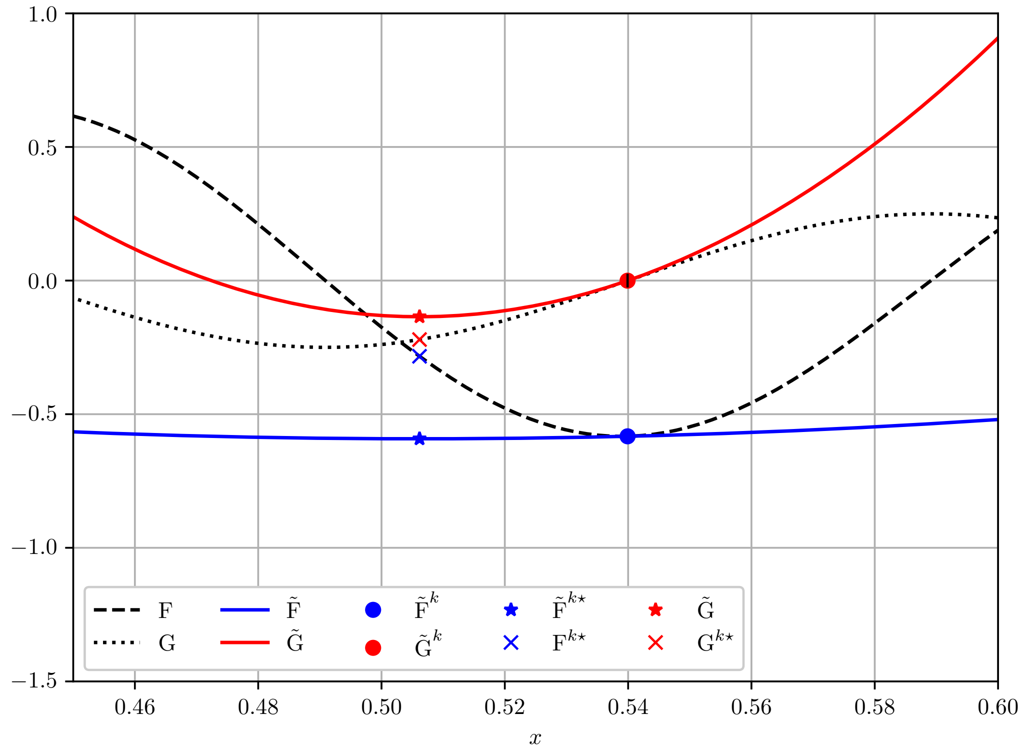
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.540$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = 0.553$
$\mathrm{dd}_x^k\mathrm{F} = 2.049$
$\alpha_\mathrm{F} = 8.000$

$\mathrm{G}^k = -0.000$
$\mathrm{d}_x^k\mathrm{G} = 8.000$
$\mathrm{dd}_x^k\mathrm{G} = 29.634$
$\alpha_\mathrm{G} = 8.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.000$
at the solution
$x^{k\star} = 0.506$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.592$
$\tilde{\mathrm{G}}^{k\star} = -0.135$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.283$
$\mathrm{G}^{k\star} = -0.221$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.

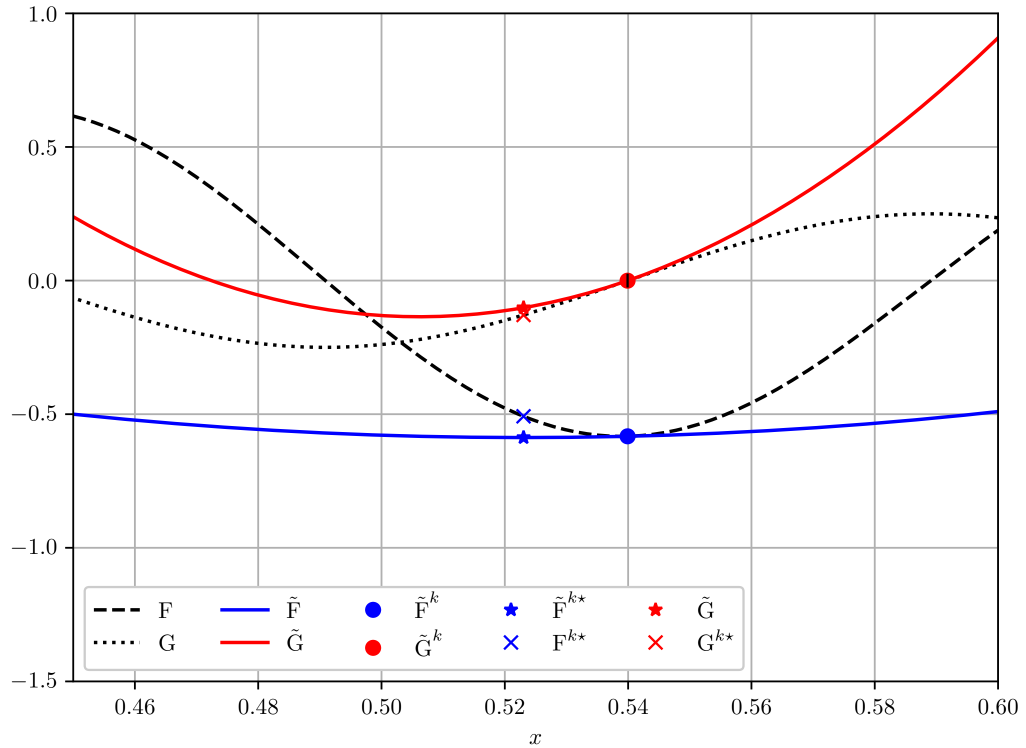
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.540$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = 0.553$
$\mathrm{dd}_x^k\mathrm{F} = 2.049$
$\alpha_\mathrm{F} = 16.000$

$\mathrm{G}^k = -0.000$
$\mathrm{d}_x^k\mathrm{G} = 8.000$
$\mathrm{dd}_x^k\mathrm{G} = 29.634$
$\alpha_\mathrm{G} = 8.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.000$
at the solution
$x^{k\star} = 0.523$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.587$
$\tilde{\mathrm{G}}^{k\star} = -0.102$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.508$
$\mathrm{G}^{k\star} = -0.129$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.

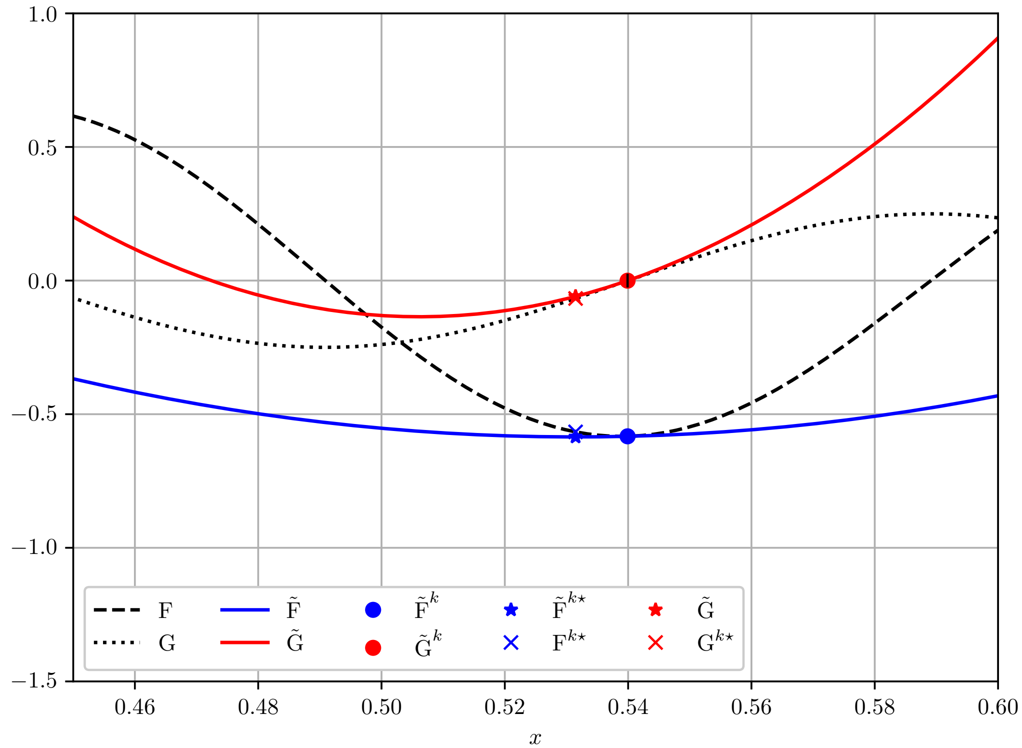
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.540$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = 0.553$
$\mathrm{dd}_x^k\mathrm{F} = 2.049$
$\alpha_\mathrm{F} = 32.000$

$\mathrm{G}^k = -0.000$
$\mathrm{d}_x^k\mathrm{G} = 8.000$
$\mathrm{dd}_x^k\mathrm{G} = 29.634$
$\alpha_\mathrm{G} = 8.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.000$
at the solution
$x^{k\star} = 0.531$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.585$
$\tilde{\mathrm{G}}^{k\star} = -0.059$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.566$
$\mathrm{G}^{k\star} = -0.067$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.

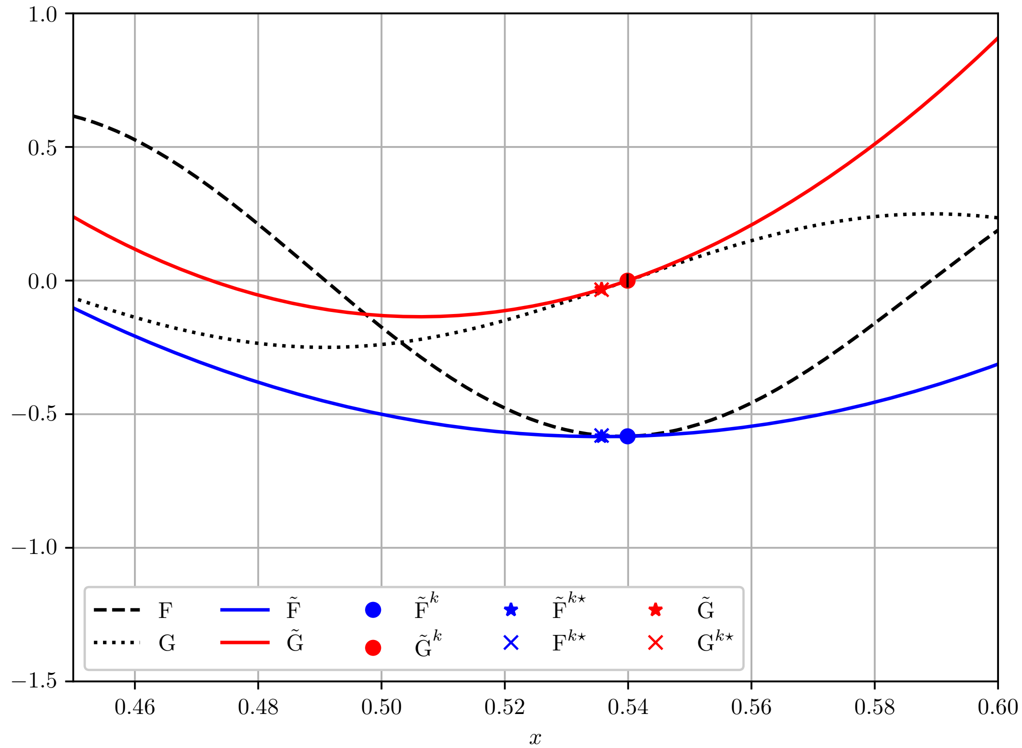
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.540$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = 0.553$
$\mathrm{dd}_x^k\mathrm{F} = 2.049$
$\alpha_\mathrm{F} = 64.000$

$\mathrm{G}^k = -0.000$
$\mathrm{d}_x^k\mathrm{G} = 8.000$
$\mathrm{dd}_x^k\mathrm{G} = 29.634$
$\alpha_\mathrm{G} = 8.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.000$
at the solution
$x^{k\star} = 0.536$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.584$
$\tilde{\mathrm{G}}^{k\star} = -0.032$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.580$
$\mathrm{G}^{k\star} = -0.034$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.

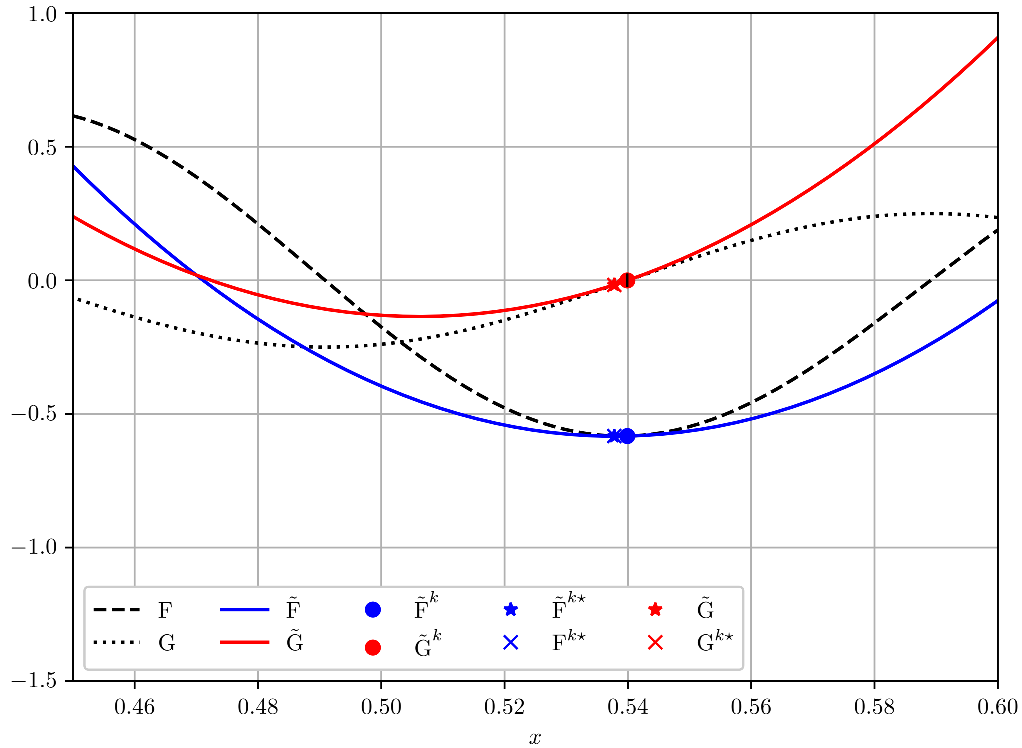
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.540$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = 0.553$
$\mathrm{dd}_x^k\mathrm{F} = 2.049$
$\alpha_\mathrm{F} = 128.000$

$\mathrm{G}^k = -0.000$
$\mathrm{d}_x^k\mathrm{G} = 8.000$
$\mathrm{dd}_x^k\mathrm{G} = 29.634$
$\alpha_\mathrm{G} = 8.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.000$
at the solution
$x^{k\star} = 0.538$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.583$
$\tilde{\mathrm{G}}^{k\star} = -0.017$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.583$
$\mathrm{G}^{k\star} = -0.017$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.

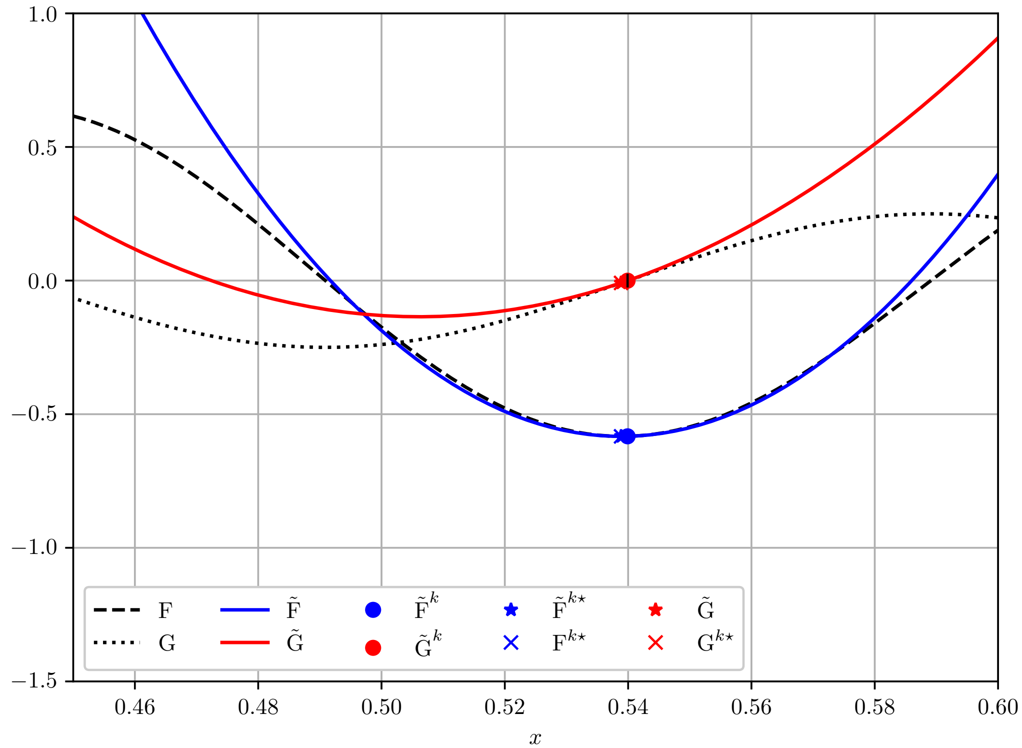
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.540$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = 0.553$
$\mathrm{dd}_x^k\mathrm{F} = 2.049$
$\alpha_\mathrm{F} = 256.000$

$\mathrm{G}^k = -0.000$
$\mathrm{d}_x^k\mathrm{G} = 8.000$
$\mathrm{dd}_x^k\mathrm{G} = 29.634$
$\alpha_\mathrm{G} = 8.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.000$
at the solution
$x^{k\star} = 0.539$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.583$
$\tilde{\mathrm{G}}^{k\star} = -0.009$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.583$
$\mathrm{G}^{k\star} = -0.009$

The solution leads to a feasible descent step and is therefore deemed *acceptable*, as is.
(Note that the objective and/or constraint function approximation is not conservative in this case.)

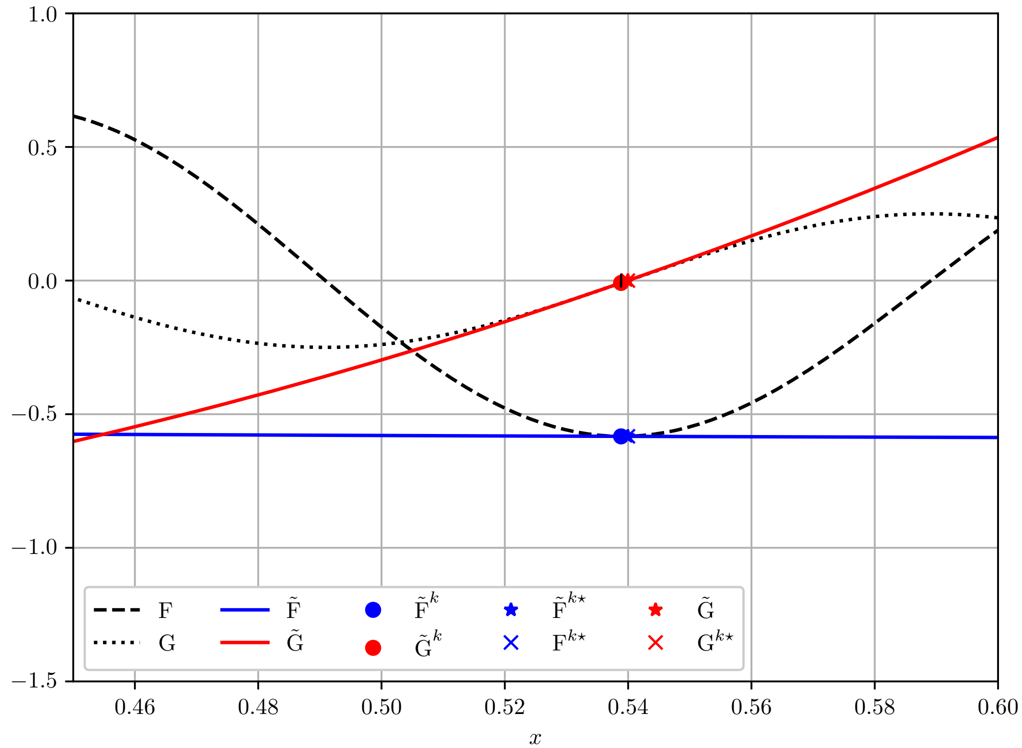
Iteration 15

QP subproblem at x^k:

$x^k = 0.539$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = -0.076$
$\mathrm{dd}_x^k\mathrm{F} = 0.284$
$\alpha_\mathrm{F} = 1.000$

$\mathrm{G}^k = -0.009$
$\mathrm{d}_x^k\mathrm{G} = 7.995$
$\mathrm{dd}_x^k\mathrm{G} = 29.674$
$\alpha_\mathrm{G} = 1.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.009$
at the solution
$x^{k\star} = 0.540$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.583$
$\tilde{\mathrm{G}}^{k\star} = 0.000$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.583$
$\mathrm{G}^{k\star} = -0.000$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.

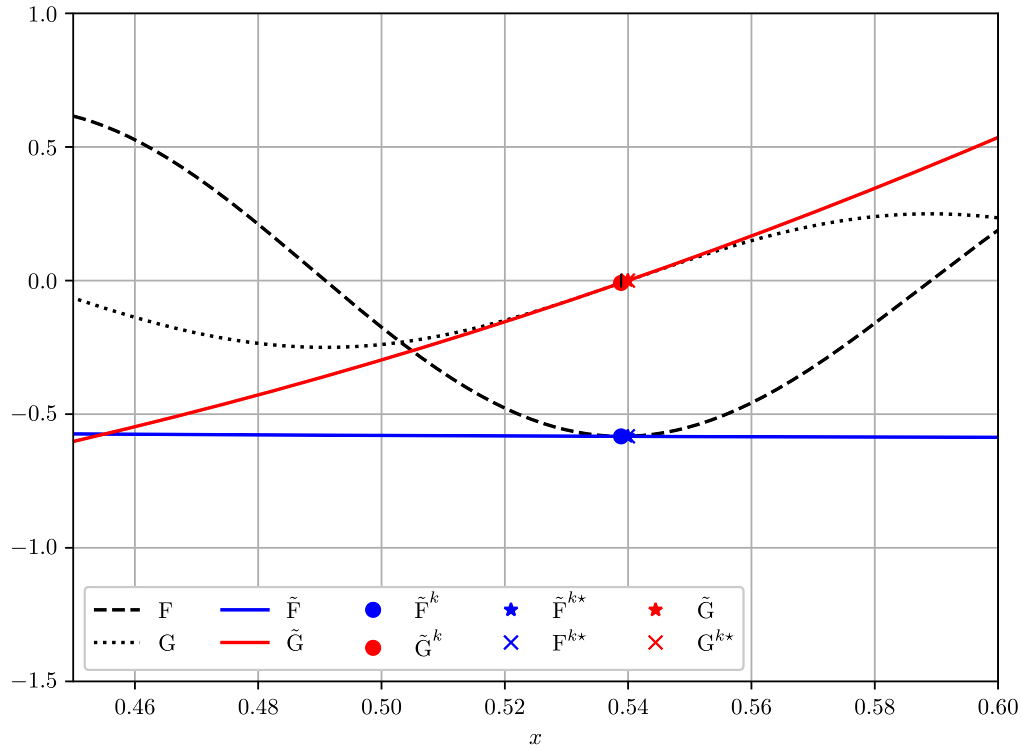
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.539$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = -0.076$
$\mathrm{dd}_x^k\mathrm{F} = 0.284$
$\alpha_\mathrm{F} = 2.000$

$\mathrm{G}^k = -0.009$
$\mathrm{d}_x^k\mathrm{G} = 7.995$
$\mathrm{dd}_x^k\mathrm{G} = 29.674$
$\alpha_\mathrm{G} = 1.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.009$
at the solution
$x^{k\star} = 0.540$



At the solution of the QP the function approximations have the values
$\tilde{\mathrm{F}}^{k\star} = -0.583$
$\tilde{\mathrm{G}}^{k\star} = -0.000$

while the actual functions are evaluated to be
$\mathrm{F}^{k\star} = -0.583$
$\mathrm{G}^{k\star} = -0.000$

However, the solution (step) is deemed *unacceptable*, because
$\rightarrow$ the value of the objective function approximation is less than the actual function value, at the new design point, $\tilde{\mathrm{F}}^{k\star} < \mathrm{F}^{k\star}$.

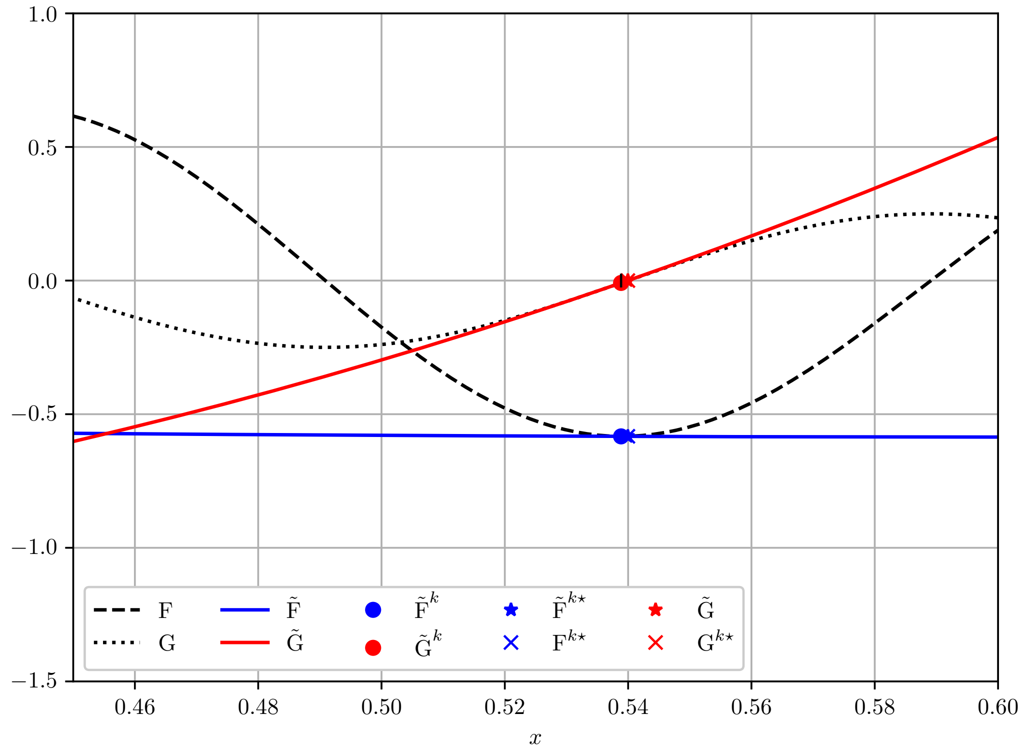
That is, at least one approximation function is not *conservative*.

QP subproblem at x^k:

$x^k = 0.539$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = -0.076$
$\mathrm{dd}_x^k\mathrm{F} = 0.284$
$\alpha_\mathrm{F} = 4.000$

$\mathrm{G}^k = -0.009$
$\mathrm{d}_x^k\mathrm{G} = 7.995$
$\mathrm{dd}_x^k\mathrm{G} = 29.674$
$\alpha_\mathrm{G} = 1.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.009$
at the solution
$x^{k\star} = 0.540$



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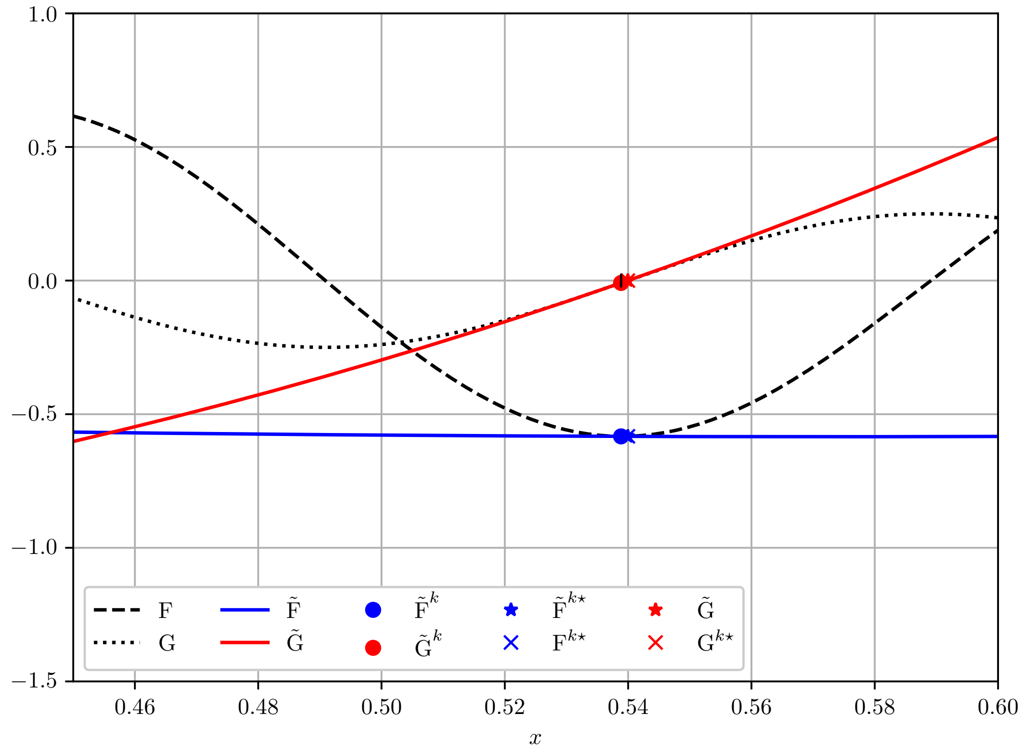
QP subproblem at x^k:

$x^k = 0.539$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = -0.076$
$\mathrm{dd}_x^k\mathrm{F} = 0.284$
$\alpha_\mathrm{F} = 8.000$

$\mathrm{G}^k = -0.009$
$\mathrm{d}_x^k\mathrm{G} = 7.995$
$\mathrm{dd}_x^k\mathrm{G} = 29.674$
$\alpha_\mathrm{G} = 1.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.009$
at the solution
$x^{k\star} = 0.540$



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$\tilde{\mathrm{G}}^{k\star} = 0.000$

while the actual functions are evaluated to be
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However, the solution (step) is deemed *unacceptable*, because
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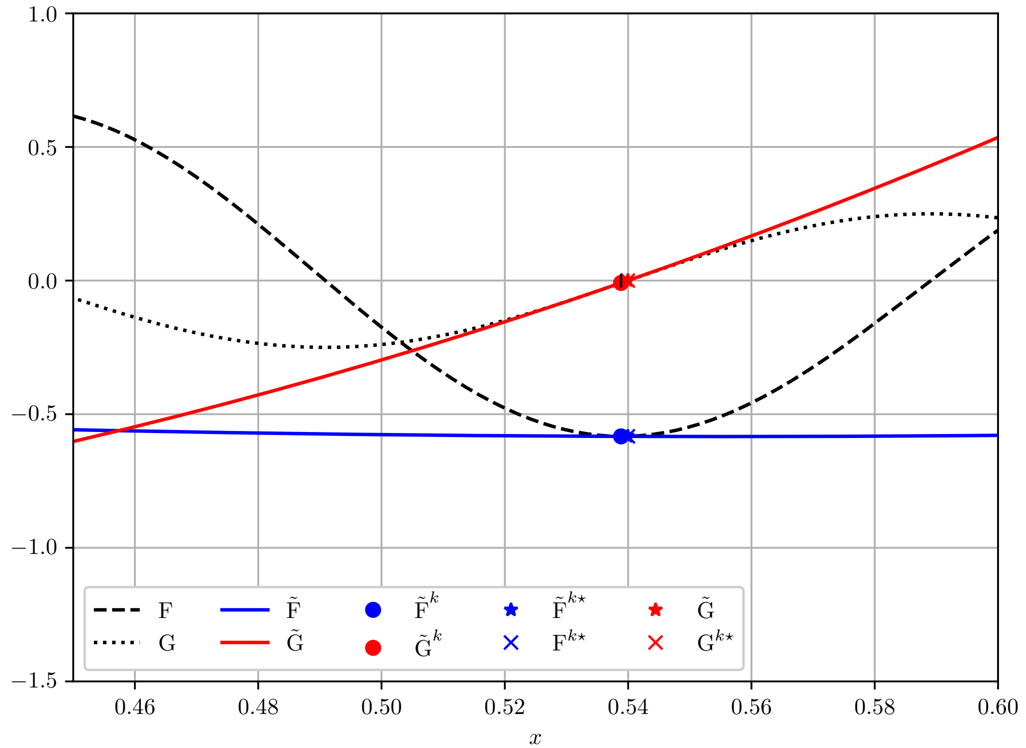
QP subproblem at x^k:

$x^k = 0.539$
$\mathrm{F}^k = -0.583$
$\mathrm{d}_x^k\mathrm{F} = -0.076$
$\mathrm{dd}_x^k\mathrm{F} = 0.284$
$\alpha_\mathrm{F} = 16.000$

$\mathrm{G}^k = -0.009$
$\mathrm{d}_x^k\mathrm{G} = 7.995$
$\mathrm{dd}_x^k\mathrm{G} = 29.674$
$\alpha_\mathrm{G} = 1.000$

with Lagrange multiplier
$\lambda^{k\star} = 0.009$
at the solution
$x^{k\star} = 0.540$



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