$$\operatorname{Res} = \lim_{z \to a} f(s)\,(s-a) \qquad \oint_\gamma f(s)\,ds = 2\pi i \sum_{k=1}^{n} \operatorname{Res}_{s_k}(f)$$

$$\|G\|_2^2 = \frac{1}{2\pi i} \oint G(-s)G(s) = \sum \operatorname{Re}$$

$$G(-s)\,G(s) = \frac{s-3}{s^2+4s+13} \cdot \frac{-s-3}{s^2-4s+13}$$

$$= \frac{9-3s+3s-s^2}{(s^2+4s)(s^2-4s) + 13(s^2+4s) + 13(s^2-4s) + 13\cdot 13} =$$

$$= \frac{-s^2+9}{s^4-16s^2+13s^2+\cancel{52s}+13s^2\cancel{-52s}+169} = \frac{-s^2+9}{s^4+10s^2+169}$$

$$= \frac{-s^2+9}{(s+2+3i)(s-2+3i)(s+2-3i)(s-2-3i)}$$

$$b = s^2 \qquad b^2+10b+169=0 \qquad b_{1,2} = \frac{10 \pm \sqrt{100-4\cdot 169}}{2}$$

$$b = \sqrt{3} = \sqrt{5 \pm 12i} \qquad = 5 \pm 12i$$

$$b = \sqrt{5^2+12^2}\; e^{i\tan(12/5)} = 13\, e^{i\,1.176+2\pi k}$$

$$s_{1,2} = \sqrt{13}\cdot e^{i\,\frac{1.176}{2}+\pi k} \qquad s_1 = \sqrt{13}\, e^{i\,0.588} \qquad s_2 = \sqrt{13}\, e^{i\,0.588+\pi}$$

$$s_1 = 2+3i \qquad s_2 = -2-3i$$

same for $s_{3,4}$ $\qquad s_3 = -2+3i \qquad s_4 = 2-3i$

$$\operatorname{Res}_{s=-2-3i} = \lim_{s \to -2-3i} (s+2+3i)\frac{-s^2+9}{\cancel{(s+2+3i)}(s+2-3i)(s-2-3i)(s-2+3i)}$$

$$= \frac{-(-2-3i)(-2-3i)+9}{(\cancel{-2}-3i+\cancel{2}-3i)(-2\cancel{-3i}-2\cancel{+3i})(-2-3i-2-3i)}$$

$$= \frac{14-12i}{-6i\cdot -4\,(-4-6i)} = \frac{14-12i}{144-96i}$$

$$\overset{!}{=} \frac{(14-12i)(144+96\,i)}{144^2+96^2} = \underline{\underline{\frac{11}{104} - \frac{1}{78}\,i}}$$

Same proceduer for residue at $s=-2+3i$

$$\operatorname{Res}_{s=-2+3i} = \lim_{s\to -2+3i} (s+2-3i)\,\frac{-s^2+9}{(s+2+3i)(s+2-3i)\,(s-2-3i)(s-2+3i)}$$

$$= \underline{\underline{\frac{11}{104} + \frac{1}{78}\,i}}$$

The two norm is $\|G\|_\infty = \sqrt{\sum \operatorname{Res}} = \sqrt{\frac{22}{104}} = \underline{\underline{0.4599331}}$