S_{12} – площадь пересечения 1 и 2 окружностей;
S_{23} – площадь пересечения 2 и 3 окружностей;
S_2 – площадь 2й окружности.
Площадь фигуры найдем по формуле 1:

$$\mathbf{mes}\,\Omega_{inters} = S_2 - (S_2 - S_{12}) - (S_2 - S_{23}) \tag{1}$$

Или, после раскрытия скобок:

$$\mathbf{mes}\,\Omega_{inters} = S_{12} + S_{23} - S_2 \tag{2}$$

S_{12} и S_{23} были найдены ранее, для моментов II порядка, $S_2 = \pi r_2^2$. В результате подстановки получаем формулу 3:

$$\begin{aligned}\mathbf{mes}\,\Omega_{inters} = r_2^2 \cdot \left(\arccos\left[\tfrac{1}{2R_{12}r_2}\cdot\left(r_2^2 - r_1^2 + R_{12}^2\right)\right] + \arccos\left[\tfrac{1}{2R_{23}r_2}\cdot\left(r_2^2 - r_1^2 + R_{23}^2\right)\right] - \pi\right) + \\ + r_1^2 \arccos\left[\tfrac{1}{2R_{12}r_1}\cdot\left(r_1^2 - r_2^2 + R_{12}^2\right)\right] + r_3^2 \arccos\left[\tfrac{1}{2R_{23}r_3}\cdot\left(r_3^2 - r_2^2 + R_{23}^2\right)\right] - \\ - 2\cdot\left(\sqrt{p_1(p_1-r_1)(p_1-r_2)(p_1-R_{12})} + \sqrt{p_2(p_2-r_3)(p_2-r_2)(p_2-R_{23})}\right)\end{aligned} \tag{3}$$

$$p_1 = \frac{1}{2}\cdot(r_1 + r_2 + R_{12}) \tag{4}$$

$$p_2 = \frac{1}{2}\cdot(r_3 + r_2 + R_{23}) \tag{5}$$

Рассмотрим частные случаи:

1. $r_i = r_j \neq r_k, i \neq j \neq k$:

$$\mathbf{K}_\lambda^{(3)}(\mathbf{r_i},\mathbf{r_i},\mathbf{r_k}) = \langle\lambda(\mathbf{r_i})\lambda(\mathbf{r_i})\lambda(\mathbf{r_k})\rangle - \nu_\mathbf{f}\left[\langle\lambda(\mathbf{r_i})\lambda(\mathbf{r_i})\rangle + \mathbf{2}\,\langle\lambda(\mathbf{r_i})\lambda(\mathbf{r_k})\rangle\right] + \mathbf{2}\nu_\mathbf{f}^\mathbf{3} \tag{6}$$

$$\begin{aligned}\langle\lambda(\mathbf{r_i})\lambda(\mathbf{r_i})\lambda(\mathbf{r_k})\rangle = \mathbf{Prob}(\mathbf{r_i}\in\mathbf{\Omega_f}\wedge\mathbf{r_i}\in\mathbf{\Omega_f}\wedge\mathbf{r_k}\in\mathbf{\Omega_f}) = \\ = \mathbf{Prob}\left[\mathbf{r_i}\in\mathbf{\Omega_f}\mid(\mathbf{r_i}\in\mathbf{\Omega_f}\wedge\mathbf{r_k}\in\mathbf{\Omega_f})\right]\times \\ \times\,\mathbf{Prob}\left[\mathbf{r_i}\in\mathbf{\Omega_f}\mid\mathbf{r_k}\in\mathbf{\Omega_f}\right]\mathbf{Prob}\left[\mathbf{r_k}\in\mathbf{\Omega_f}\right]\end{aligned} \tag{7}$$

$$\begin{aligned}\langle\lambda(\mathbf{r_i})\lambda(\mathbf{r_i})\lambda(\mathbf{r_k})\rangle = \mathbf{Prob}(\mathbf{r_i}\in\mathbf{\Omega_f}\wedge\mathbf{r_k}\in\mathbf{\Omega_f})\mathbf{Prob}(\mathbf{r_i}\in\mathbf{\Omega_f}\mid\mathbf{r_k}\in\mathbf{\Omega_f})\mathbf{Prob}(\mathbf{r_k}\in\mathbf{\Omega_f}) = \\ = \mathbf{Prob}(\mathbf{r_i}\in\mathbf{\Omega_f}\mid\mathbf{r_k}\in\mathbf{\Omega_f})\cdot\nu_\mathbf{f}\cdot\mathbf{Prob}(\mathbf{r_i}\in\mathbf{\Omega_f}\mid\mathbf{r_k}\in\mathbf{\Omega_f})\mathbf{Prob}(\mathbf{r_k}\in\mathbf{\Omega_f})\end{aligned} \tag{8}$$

$$\langle\lambda(\mathbf{r_i})\lambda(\mathbf{r_i})\lambda(\mathbf{r_k})\rangle = \frac{\mathbf{mes}(\mathbf{\Omega_f^i}\cap\mathbf{\Omega_f^k})}{\mathbf{mes}(\mathbf{\Omega_f})}\cdot\nu_\mathbf{f}\cdot\frac{\mathbf{mes}(\mathbf{\Omega_f^i}\cap\mathbf{\Omega_f^k})}{\mathbf{mes}\mathbf{\Omega_f}}\cdot\nu_\mathbf{f} = \left(\frac{\mathbf{mes}(\mathbf{\Omega_f^i}\cap\mathbf{\Omega_f^k})}{\mathbf{mes}\widehat{\mathbf{\Omega}}}\right)^\mathbf{2} \tag{9}$$

$$\langle\lambda(\mathbf{r_i})\lambda(\mathbf{r_i})\rangle = \mathbf{Prob}(\mathbf{r_i}\in\mathbf{\Omega_f}\wedge\mathbf{r_i}\in\mathbf{\Omega_f}) = \mathbf{Prob}(\mathbf{r_i}\in\mathbf{\Omega_f}) = \nu_\mathbf{f} \tag{10}$$

$$\langle\lambda(\mathbf{r_i})\lambda(\mathbf{r_k})\rangle = \mathbf{Prob}(\mathbf{r_i}\in\mathbf{\Omega_f}\mid\mathbf{r_k}\in\mathbf{\Omega_f})\cdot\nu_\mathbf{f} = \frac{\mathbf{mes}(\mathbf{\Omega_f^i}\cap\mathbf{\Omega_f^k})}{\mathbf{mes}\widehat{\mathbf{\Omega}}} \tag{11}$$

$$\begin{aligned}\mathbf{K}_\lambda^{(3)}(\mathbf{r_i},\mathbf{r_i},\mathbf{r_k}) = \left[\tfrac{\mathbf{mes}(\mathbf{\Omega_f^i}\cap\mathbf{\Omega_f^k})}{\mathbf{mes}\widehat{\mathbf{\Omega}}}\right]^\mathbf{2} - \nu_\mathbf{f}\cdot\left[\nu_\mathbf{f} + \mathbf{2}\tfrac{\mathbf{mes}(\mathbf{\Omega_f^i}\cap\mathbf{\Omega_f^k})}{\mathbf{mes}\widehat{\mathbf{\Omega}}}\right] + \mathbf{2}\nu_\mathbf{f}^\mathbf{3} = \\ = \tfrac{\mathbf{mes}(\mathbf{\Omega_f^i}\cap\mathbf{\Omega_f^k})}{\mathbf{mes}\widehat{\mathbf{\Omega}}}\left[\tfrac{\mathbf{mes}(\mathbf{\Omega_f^i}\cap\mathbf{\Omega_f^k})}{\mathbf{mes}\widehat{\mathbf{\Omega}}} - \mathbf{2}\nu_\mathbf{f}\right] - \nu_\mathbf{f}^\mathbf{2} + \mathbf{2}\nu_\mathbf{f}^\mathbf{3}\end{aligned} \tag{12}$$