



A New Method of Roughness Influence Calculation.

Resistive - Roughness Coupling Impedance.

M. Ivanyan, V.Tsakanov (CANDLE / YSU)

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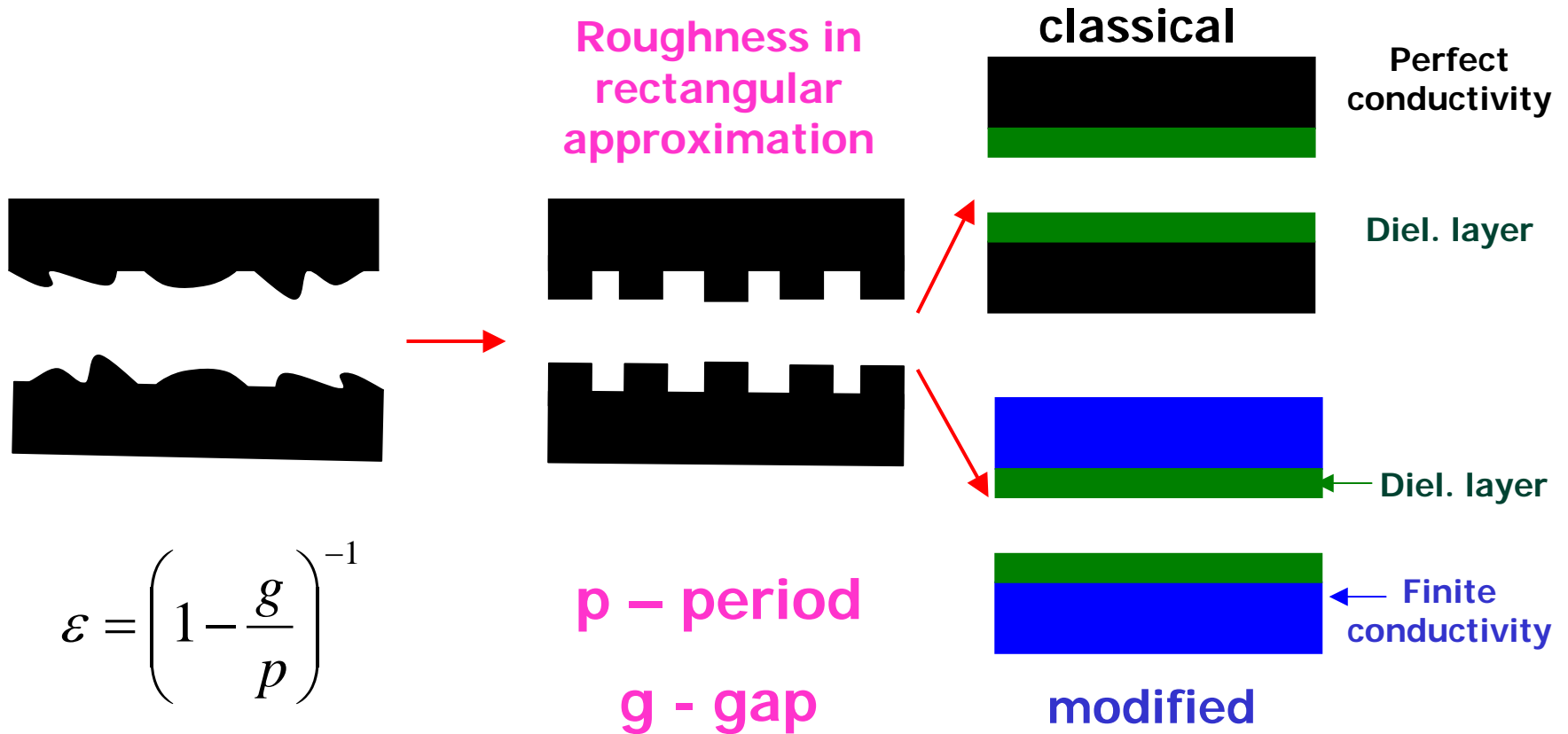
CANDLE

CONTENS

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- 4 Wake functions**
- 5 Loss and Kick factors**

NTW METHOD FOR THE ROUGH WAKE CALCULATION

NTW – Novokhatskii - Timm - Weiland



Examples

Investigation is performed for the SwissFEL undulator vacuum chamber

Round tube approximation

Material - Al



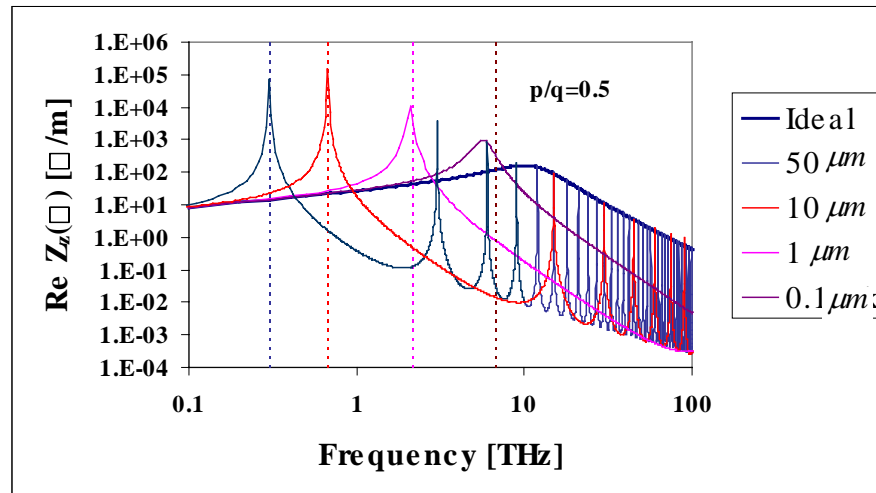
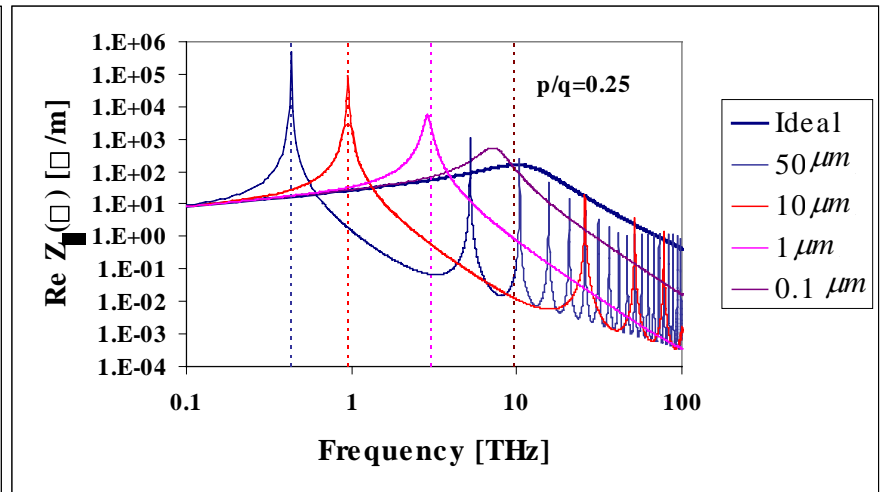
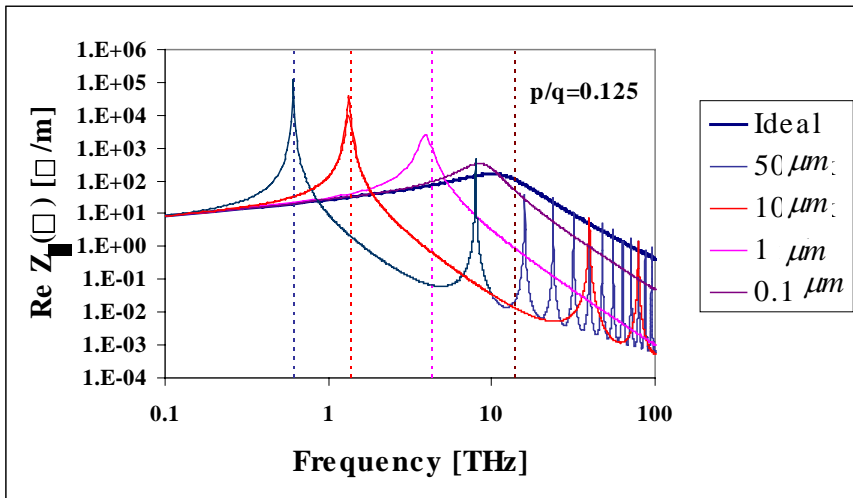
$$k_0 = \sqrt{\frac{2\varepsilon}{(\varepsilon - 1)b\delta}}$$

Resonance
wave
number

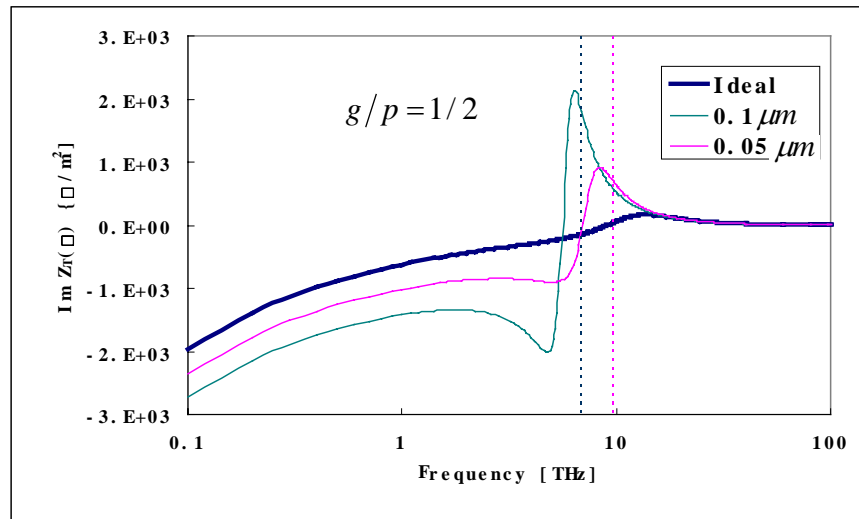
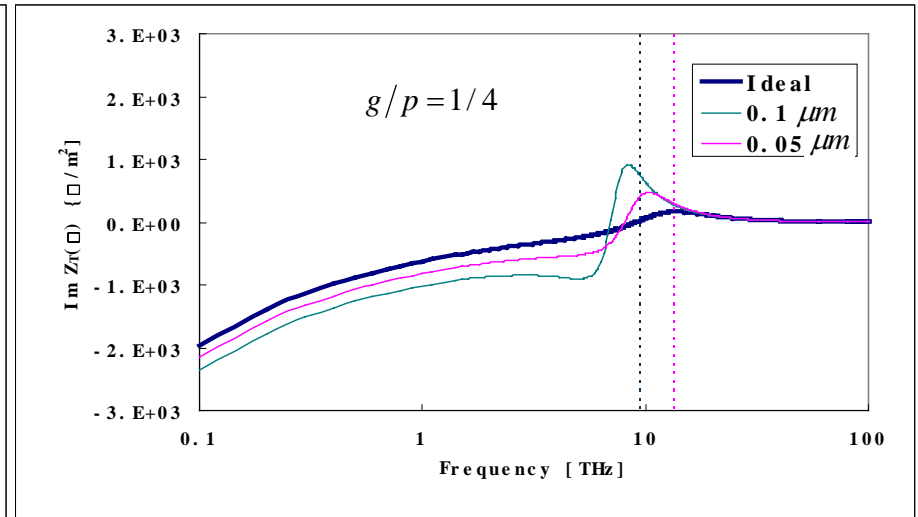
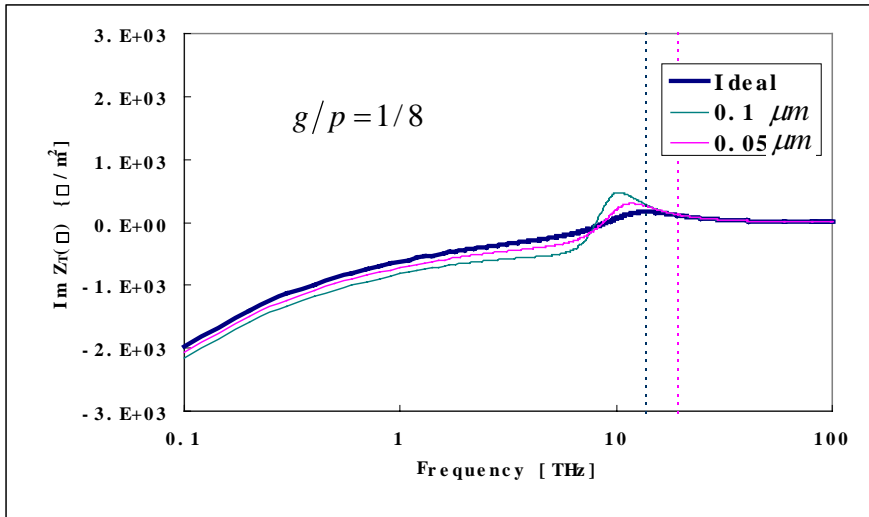


b – inner radius, δ – depth of roughness

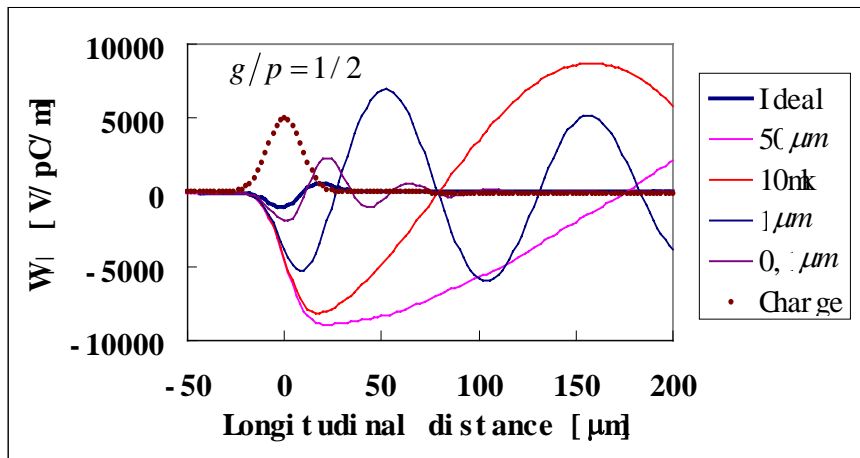
Longitudinal Impedance



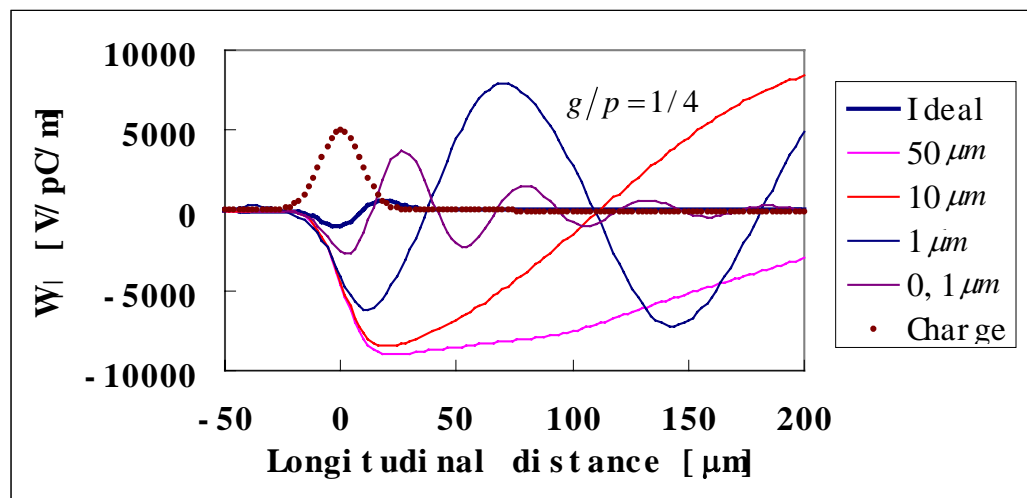
Transverse Impedance



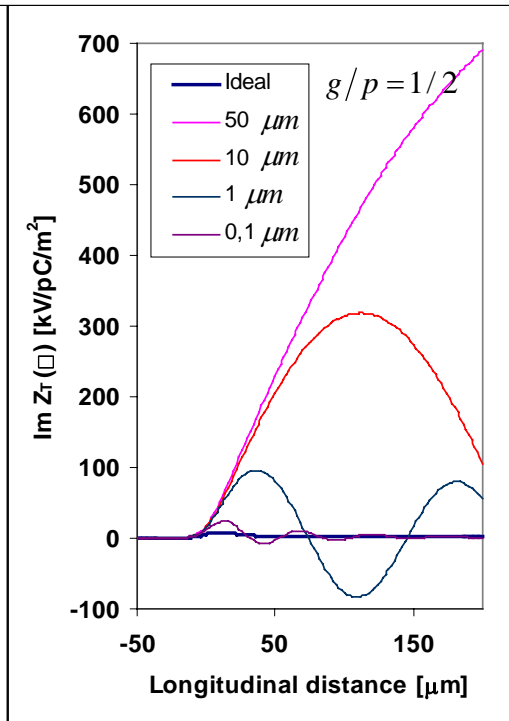
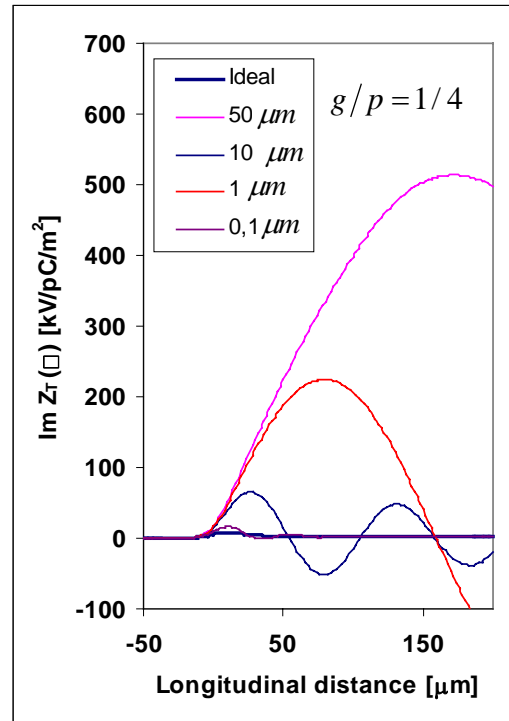
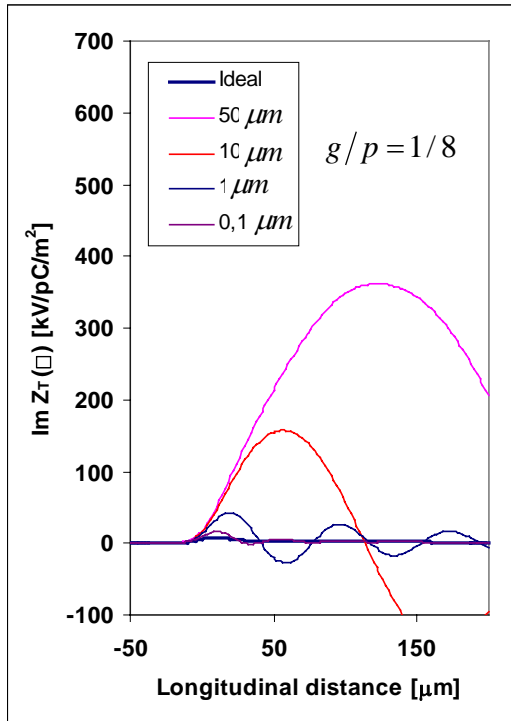
Longitudinal Wakefunction



$$\sigma_z = 9 \mu\text{m}$$



Transverse Wakefunction



Loss factor for PSI-XFEL undulator vacuum chamber (V/pC/m)

	0.05 μm	0.1 μm	1 μm
g/p=1/8	636	756	2646
g/p=1/4	756	1036	3369
g/p=1/2	1036	1592	3868

For the resistive walls without roughness the longitudinal loss factor for the PSI-XFEL undulator is equal to **540 V/pC/m.**

Kick factor for PSI-XFEL undulator vacuum chamber (kV/pC/m²)

	0.05 μ m	0.1 μ m	1 μ m
g/p=1/8	6	7	16
g/p=1/4	7	8.8	20.1
g/p=1/2	8.8	11	28

For the resistive walls without roughness the transverse kick factor for the PSI_XFEL undulator is equal to **5 kV/pC/m²**.

CONCLUSION

1. The method of resistive – roughness coupling impedance and wake functions calculation is obtained.
2. The main properties of the impedance behaviors are investigated