

$$V_b = - \int_0^b E_x(x) dx \quad (1)$$

$$E_x(x)$$

x

[]

$$V_b = - \int_0^b E_x(x) dx \approx - \frac{h}{3} [E(0) + 4E(h) + E(b)] \quad (2)$$

$$h = \frac{b}{2}$$

()

$$V_b = - \int_0^b E_x(x) dx \approx - \frac{h}{6} \left[E(0) + 4E\left(\frac{h}{2}\right) + 2E(h) + 4E\left(\frac{3h}{2}\right) + E(b) \right] \quad (3)$$

Pockels

N

[]

$$V_b \approx - \frac{h}{3n} \left[E(0) + E(b) + 4 \sum_{i=1}^n E\left(\frac{2i-1}{n}h\right) + 2 \sum_{i=1}^{n-1} E\left(\frac{2i}{n}h\right) \right] \quad (4)$$

[]

[]

$$h = \frac{b}{2} \quad n = \frac{N-1}{2}$$

()

b a

()

$$V_{ba} = - \int_{\Gamma_{ab}} \vec{E} \cdot d\vec{l} \quad (5)$$

b a

Γ_{ab}

x

Γ_{ab}

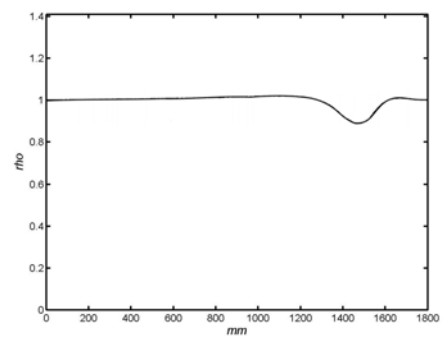
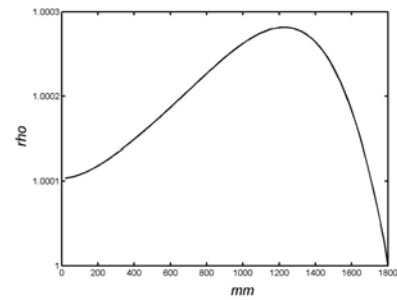
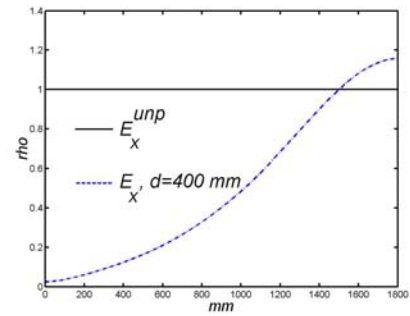
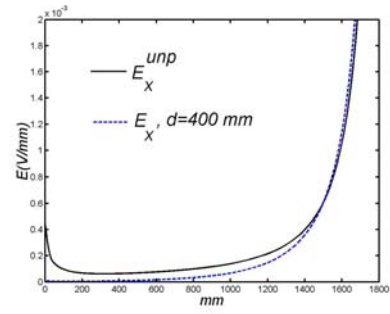
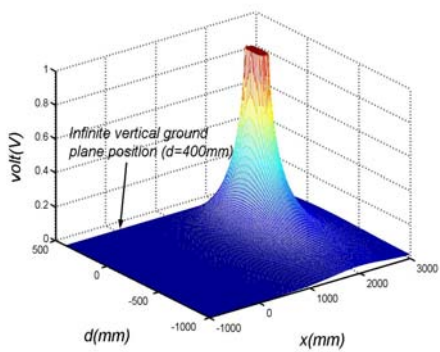
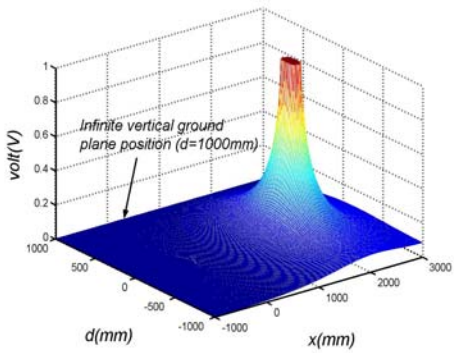
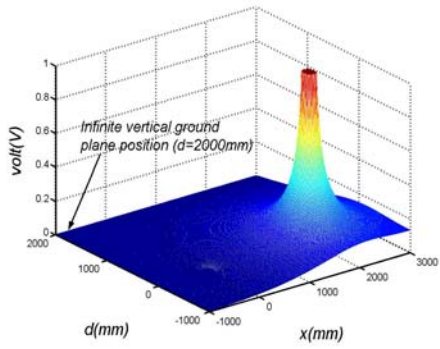
()

a

() () ()

d=2000mm

d=400mm d=1000mm



(:

(d=400mm

d=400mm

d= mm (d= mm (d= mm (

X

OVT

d

OVT

(

(

.N=5

N=5	C=17.4161	C=17.556	C=17.6436	C=17.7019
d=400mm	0.0001%	-0.5276%	-0.8542%	-1.0700%
d=600mm	0.5032%	-0.0000%	-0.3115%	-0.5172%
d=800mm	0.6869%	0.1959%	-0.1080%	-0.3087%
d=1000mm	0.7825%	0.2992%	0.0001%	-0.1975%
d=1500mm	0.9075%	0.4352%	0.1428%	-0.0503%
d=2000mm	0.9500%	0.4815%	0.1915%	-0.0000%

d=2000mm d=400mm

(x=b x=0)

OVT

.N=41

N=41	error
d=400mm	1.4433%
d=600mm	1.3820%
d=800mm	1.3506%
d=1000mm	1.3307%
d=1500mm	1.3027%
d=2000mm	1.2930%

() () ()

N=5 N=3

OVT d

OVT

.N=3

N=3	C=13.9335	C=13.9048	C=13.9697	C=14.0765
d=400mm	0.0001%	0.1654%	-0.2076%	-0.8147%
d=600mm	-0.1571%	0.0001%	-0.3546%	-0.9319%
d=800mm	0.1924%	0.3453%	0.0002%	-0.5615%
d=1000mm	0.4228%	0.5731%	0.2341%	-0.3177%
d=1500mm	0.6583%	0.8047%	0.4743%	-0.0637%
d=2000mm	0.7156%	0.8607%	0.5332%	0.0001%

OVT

() () ()

N=5 N=3

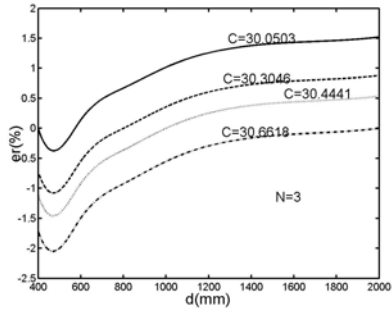
OVT d

.N=5

N=5	C=7.4094	C=7.4374	C=7.4481	C=7.4586
d=400mm	-0.0001%	-0.2189%	-0.3022%	-0.3838%
d=600mm	0.2076%	-0.0002%	-0.0793%	-0.1568%
d=800mm	0.2795%	0.0771%	0.0000%	-0.0754%
d=1000mm	0.3072%	0.1082%	0.0324%	-0.0417%
d=1500mm	0.3317%	0.1375%	0.0636%	-0.0088%
d=2000mm	0.3376%	0.1451%	0.0719%	0.0001%

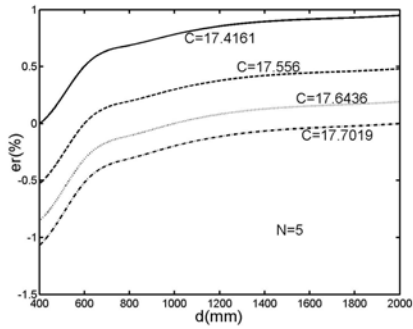
.N=3

N=3	C=30.0503	C=30.3046	C=30.4441	C=30.6618
d=400mm	0.0000%	0.7211%	1.1119%	1.7150%
d=600mm	0.1393%	0.5488%	0.9216%	1.4971%
d=800mm	0.6710%	0.0001%	-0.3635%	-0.9247%
d=1000mm	1.0179%	0.3578%	0.0001%	-0.5520%
d=1500mm	1.4107%	0.7659%	0.4164%	-0.1229%
d=2000mm	1.5209%	0.8814%	0.5348%	-0.0001%

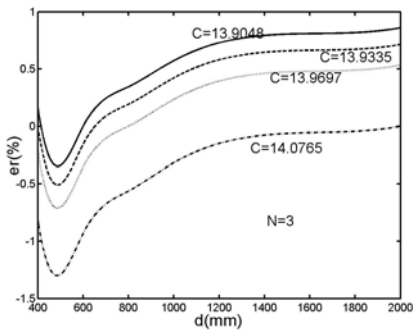


N=41

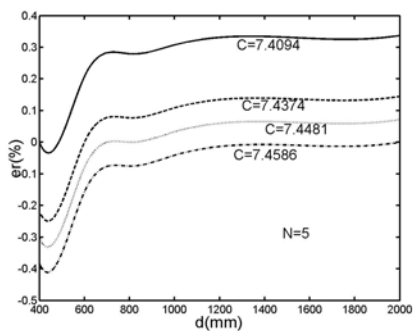
N=41	error
d=400mm	-10.8599%
d=600mm	-10.3966%
d=800mm	-10.1602%
d=1000mm	-10.0101%
d=1500mm	-9.7989%
d=2000mm	-9.7254%



N=41



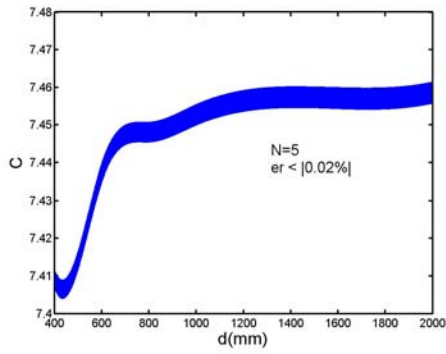
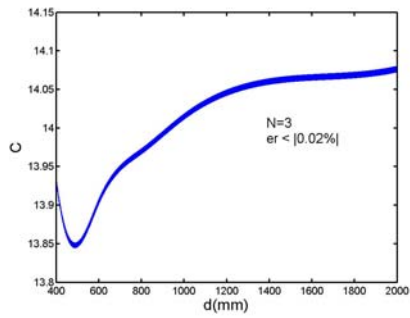
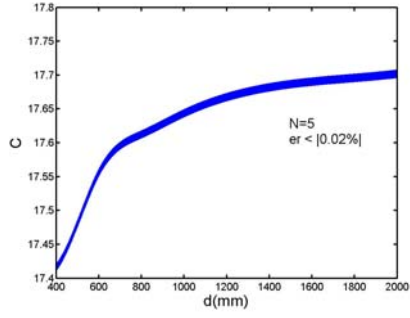
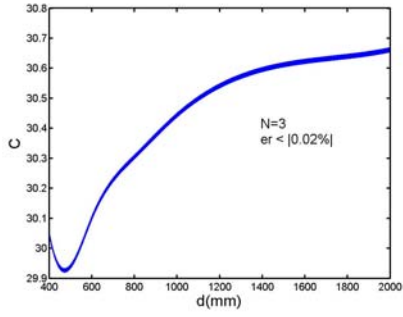
0.0001% C=17.4161 d=400mm N=5
 d=2000mm N=5
 N=3 0.0000% C=17.7019
 0.0000% C=30.0503 d=400mm
 C=30.6618 d=2000mm
 0.0001%



C=7.4094 d=400mm N=5
 d=2000mm N=5 0.0001%
 N=3 0.0001% C=7.4586
 0.0001% C=13.9335 d=400mm
 C=14.0765 d=2000mm
 0.0001%

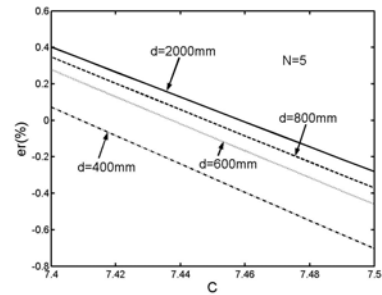
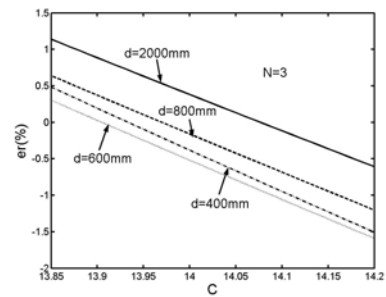
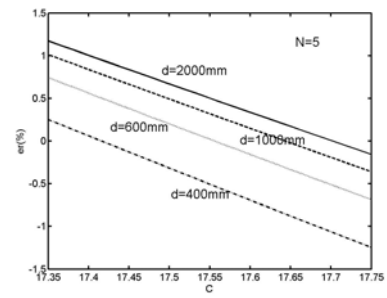
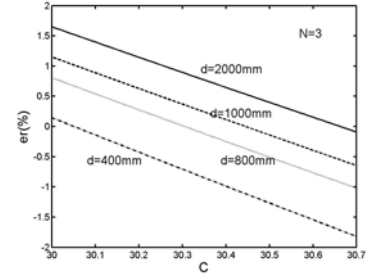
OVT

(d)
 (N=3 (C)
 (N=5 () () ()
 (N=3 C
 .N=5



()

C



OVT (C) :

(d)

(|0.02%|

(d)

(N=3

(N=5

(N=3

.N=5

(C)

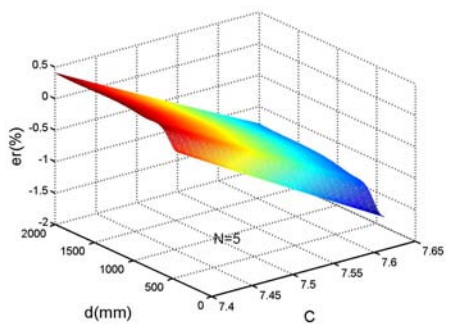
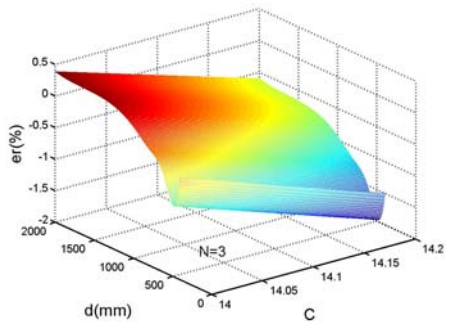
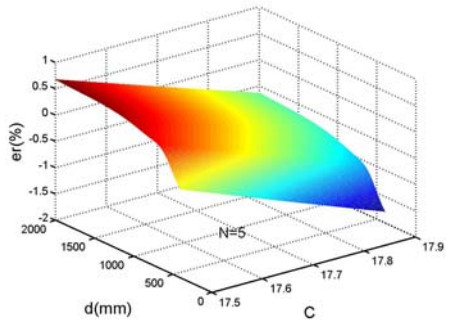
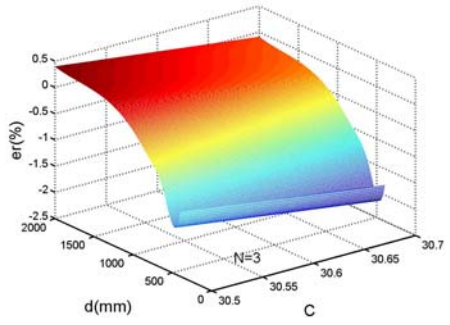
OVT

(N=3

(N=5

(N=3

.N=5



OVT :

- (C) (d) (N=3
- (N=5
- (N=3

.N=5

()
d (C)

() ()
C ()

d C ()
% /

h d er ()

C
C
C C

()
C ()

() () () ()

-
- 1 - Rahmatian, F., Romalo, D., Lee, S., Fekete, A., Liu, S., Jaeger, N. A. F. and Chavez, P. (2000). "Optical voltage transducers for high_ Voltage applications." *In proc. 2nd EPRI Optical Sensor System Workshop*, Atlanta, GA, Jan.26-28.
 - 2 - Rahmatian, F., Chavez, P. P. and Jaeger, N. A. F. (2001). "A wide_ band high accuracy SF6_free optical voltage transformer." *EPRI Optical Sensor System Workshop*.
 - 3 - Chavez, P. P., Rahmatian, F. and Jaeger, N. A. F. (2001). "230 kV Optical voltage transducer using a distributed optical electric field sensor system." *IEEE Transmission & Distribution Conference*.
 - 4 - Rahmatian, F., Chavez, P. P. and Jaeger, N. A. F. (2002). "230 kV Optical voltage transducer using multiple electric field sensors." *IEEE Transacion on Power Delivery*.
 - 5 - Rahmatian, F. and Chavez, P. P. (2001). "Wide_band 138 kV distributed _ sensor optical voltage transducer: study of accuracy under pollution and other field disturbance." *IEEE. Reprinted with Permission from, PES Summer Power Meeting*.
 - 6 - Rahmatian, F. Chavez, P. P. and Jaeger, N. A. F. (2002). "138 kV and 345 kV wide_band SF6 free optical voltage transducers." *PES Winter Power Meeting*.
 - 7 - Santos, J. C., Taplamacioglu, M. C. and Hidaka, K. (2000). "Pockels high-voltage measurement system." *IEEE Transactions on Power Delivery*, Vol.15, No.1, PP. 8-13.
 - 8 - Passard, M., Barthod, C. Fortin, M., Galez, C. and Bouillot, J. (2001). "Design and optimization of a low-frequency electric field sensor using pockels effect." *IEEE Transaction on Instrumentation and Measurement*, Vol.50, No.5, PP. 1053-1058.
 - 9 - Jager, N. A. F. and Rahmatian, F. (1995). "Integrated optics pockels cell high-voltage sensor." *IEEE Transactions on Power Delivery*, Vol.10, No.1, PP. 127-134.
-

-
- 10 - Hidaka, K. (1996). "Progress in Japan of space charge field measurement in gaseous dielectrics using pockels sensors." *IEEE Electrical Insulation Magazine*, Vol.12, No.1, PP. 17-28.
 - 11 - Li, C. and Yoshino, T. (2002). "Optical voltage sensor based on electro optic crystal multiplier." *Journal of Lightwave Technology*, Vol.20, No.5, PP. 843-849.
 - 12 - Filippov, V. N., Stardumov, A. N., Barmenkov, Y. O. and Makarov, V. V. (2000). "Fiber-optic voltage sensor based on a $\text{Bi}_{12}\text{TiO}_{20}$ crystal." *Applied Optics*, Vol.39, No.9, PP. 1389-1393.
 - 13 - Sawa, T., Kurosawa, K., Kaminishi, T. and Yokota, T. (1990). "Development of optical instrument transformers." *IEEE Transactions on Power Delivery*, Vol.5, No.2, PP. 884-891.
 - 14 - Chavez, P. P. and Jaeger, N. A. F. and Rahmatian, F. (2003). "Accurate voltage measurement by the quadrature method." *IEEE Trans. Power Delivery*, Vol.18, No.1, PP. 14-19.
 - 15 - Monsef, H. and Ghomian, T. (2006). "Modified quadrature method for accurate voltage measurement in optical voltage transducer." *IEE Proc. Generation, Transmission & Distribution*, Vol. 153, No. 5, PP. 524-530.
 - 16 - Burden, R. L. and Douglas Faires, J. (2001). *Numerical Analysis*, Thomson, PP. 234-236.

- 1 - Modified Adaptive Method
- 2 - Correction Factor
- 3 - Integrated Optic Pockels Cell (IOPC)
- 4 - Optical Voltage Transducer