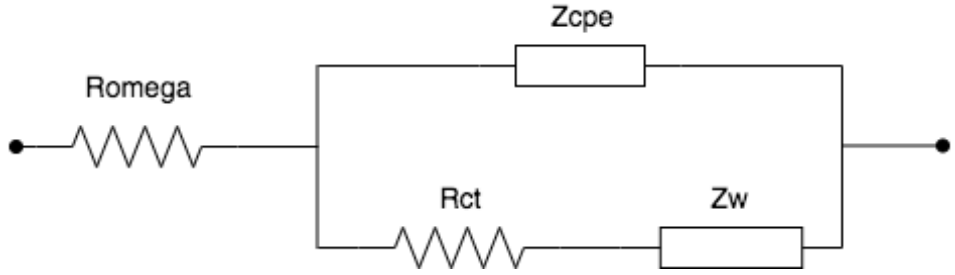
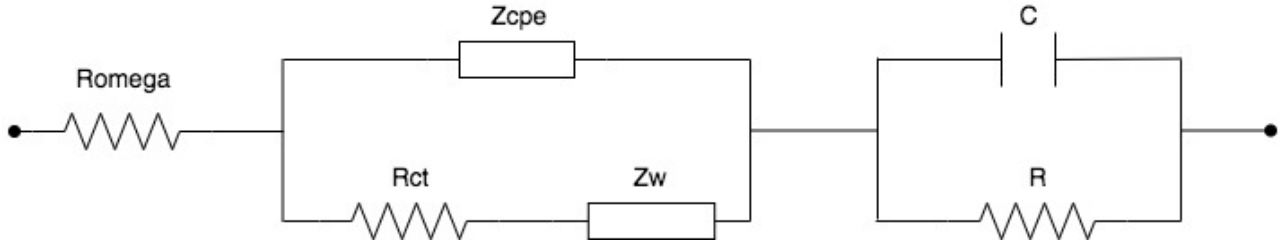
Fitting Curve Sperimentali con EA + lsqcurvefit

Nel seguente documento sono state prese in considerazione 11 curve sperimentali tra le 450 a disposizione.
Per ognuna di esse è stato effettuato il fitting con l'unione del genetico ed il deterministico, andando ad utilizzare 4 modelli differenti. I modelli utilizzati sono qui sotto riportati:

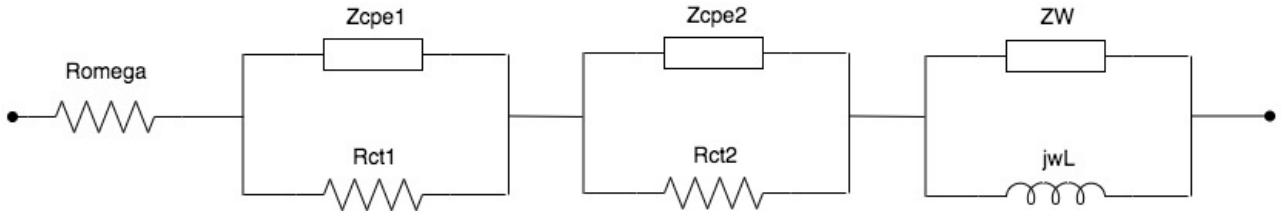
Fouquet



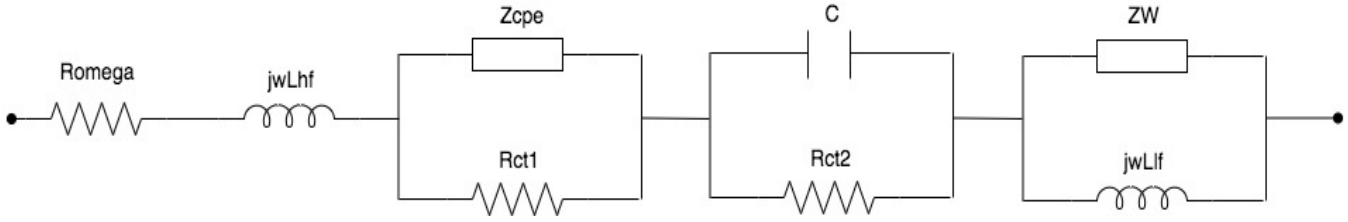
Fouquet + RC



Dhirde



DhirdeCL



In base ai risultati ottenuti, sotto riportati, si possono effettuare le seguenti considerazioni:

1. Il modello di Dhirde e DhirdeCL riescono ad individuare il terzo cerchio quando presente (Ultima curva).
2. Il modello di DhirdeCL funziona meglio rispetto il modello di Dhirde quando la curva scende sotto lo zero ad alta frequenza. Questo è dovuto alla presenza dell'induttore in serie alla Romega.
3. Il modello di Fouquet + Rc sembra dare risultati migliori rispetto a Fouquet. Si può vedere che in alcune curve, Fouquet+RC cerca di fittare anche la terza curva, ma il risultato è sempre peggiore rispetto a quanto ottenuto con il modello di Dhirde

Risultati ottenuti

Nelle prossime pagine sono riportati i risultati ottenuti.
In particolare per ogni curva sono riportati:

- Nome della curva sperimentale;
- Un grafico con la curva sperimentale, il fitting tramite il modello di Fouquet ed il fitting tramite il modello di Fouquet + RC;
- Un grafico con la curva sperimentale, il fitting tramite il modello di Dhirde ed il fitting tramite il modello di DhirceCL;
- Parametri del circuito equivalente ed il valore della funzione obiettivo;
- Grafico che mette in relazione la parte reale e la parte immaginaria con la frequenza;

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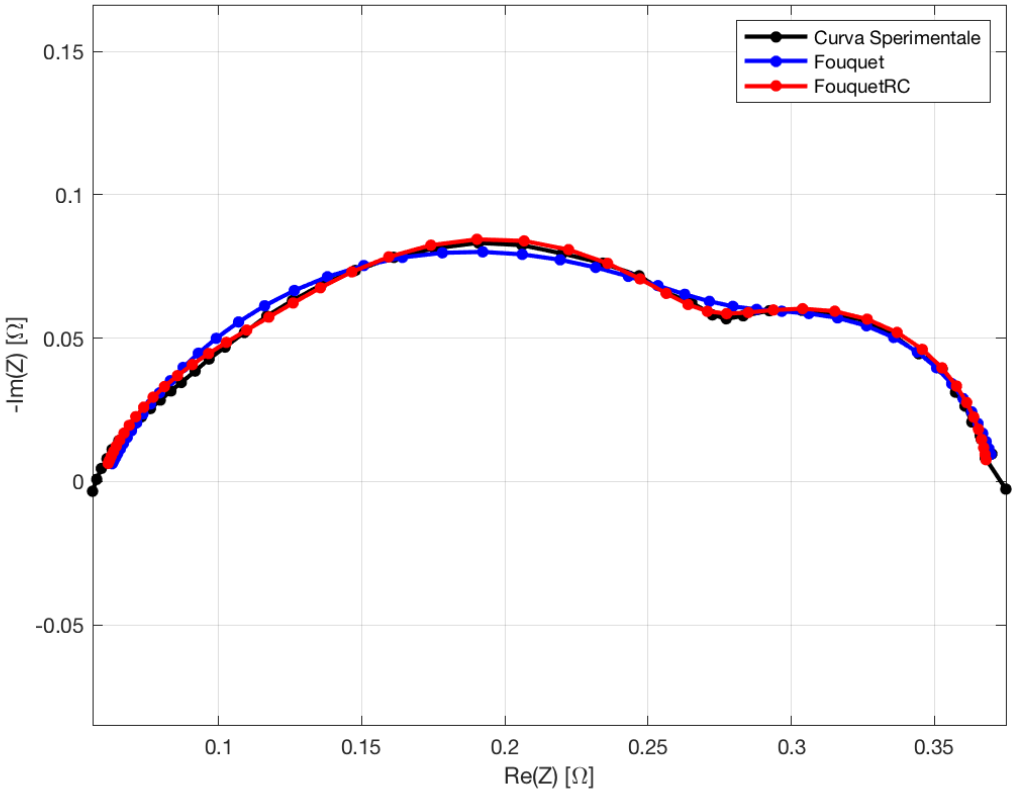
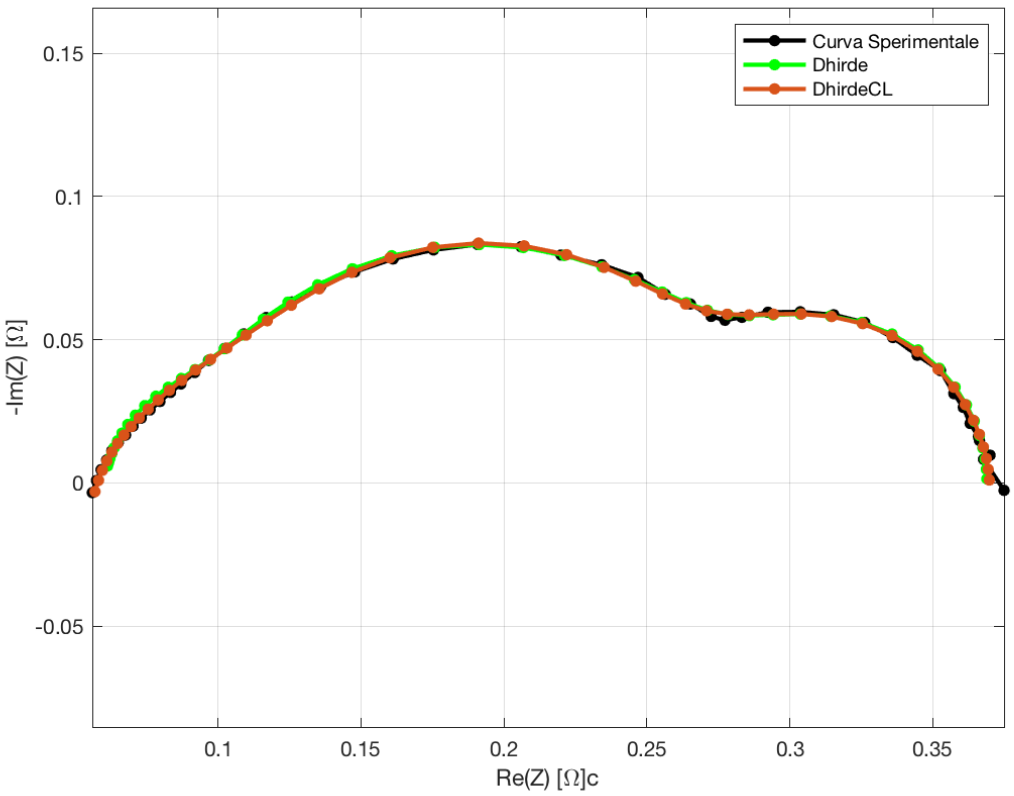




Fouquet

Fobj = 0.03444;

Romega	Rct	Q	Phi	Rd	Taud
0.0599	0.2362	0.1450	0.7300	0.0765	0.5218

Fouquet + RC

Fobj = 0.02279;

Romega	Rct	Q	Phi	Rd	Taud	R	C
0.0593	0.0808	0.0754	0.8114	0.1145	0.5080	0.1141	0.1219

Dhirde

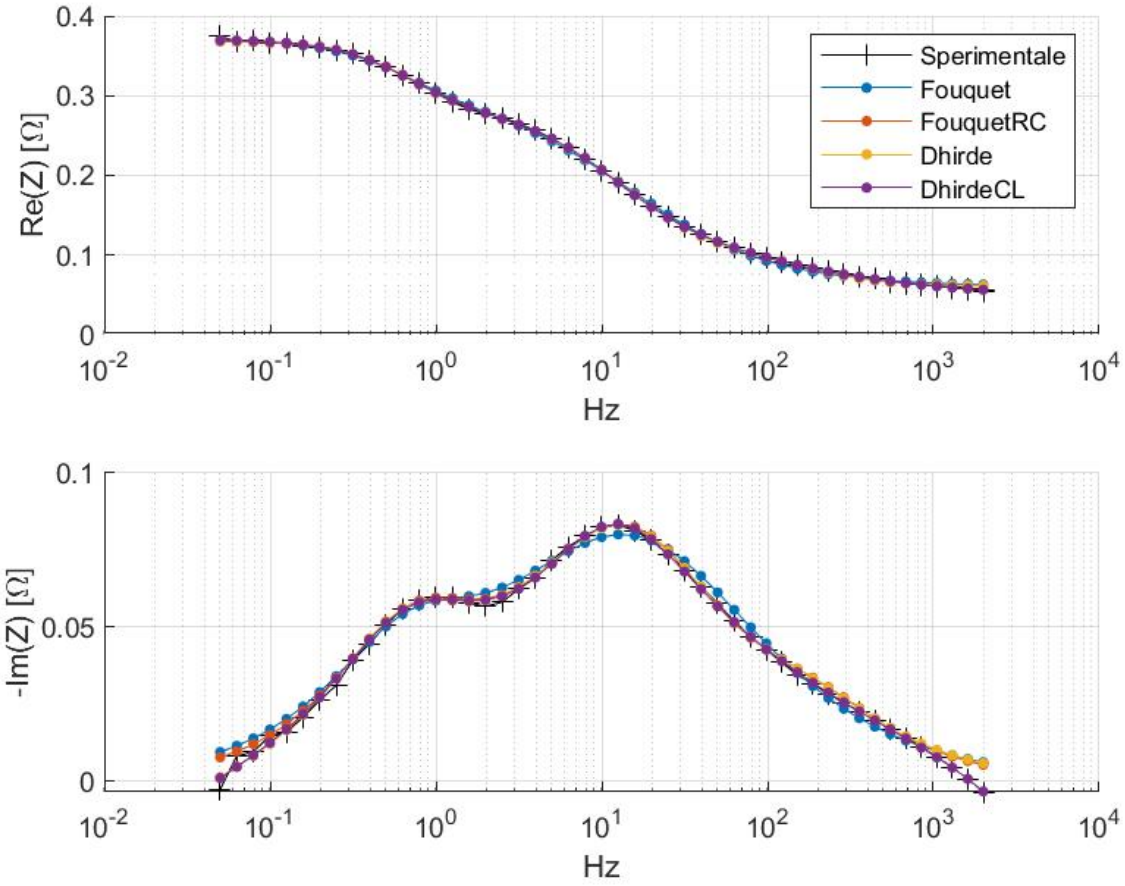
Fobj = 0.02066;

Romega	Rct1	Rct2	Q1	Q2	Phi1	Phi2	Rd	Taud	L
0.0597	0.0267	0.1758	0.0295	0.1212	1.0000	0.8618	0.1070	0.5890	5.5726

DhirdeCL

Fobj = **0.01303**;

Romega	Rct1	Rct2	Q	Phi	Rd	Taud	Lhf	Llf	C
0.0473	0.1324	0.0791	0.4653	0.5790	0.1145	0.0320	1.08 e-6	5.0170	2.9419



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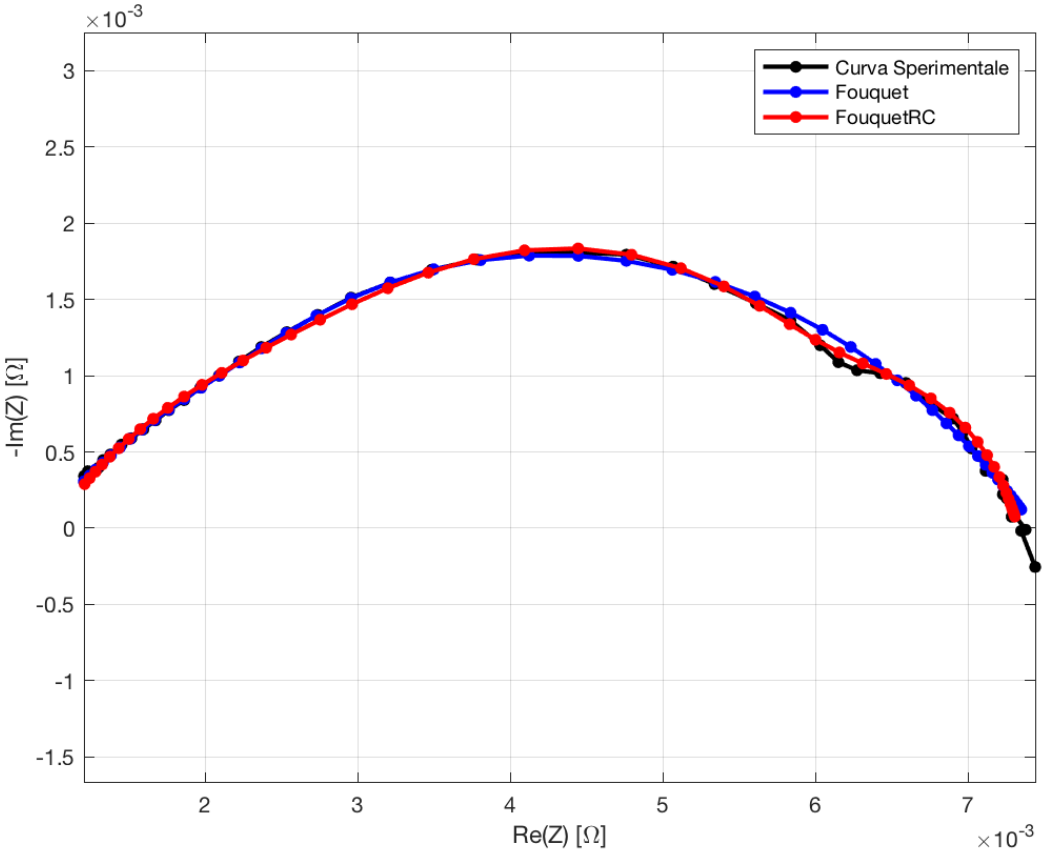
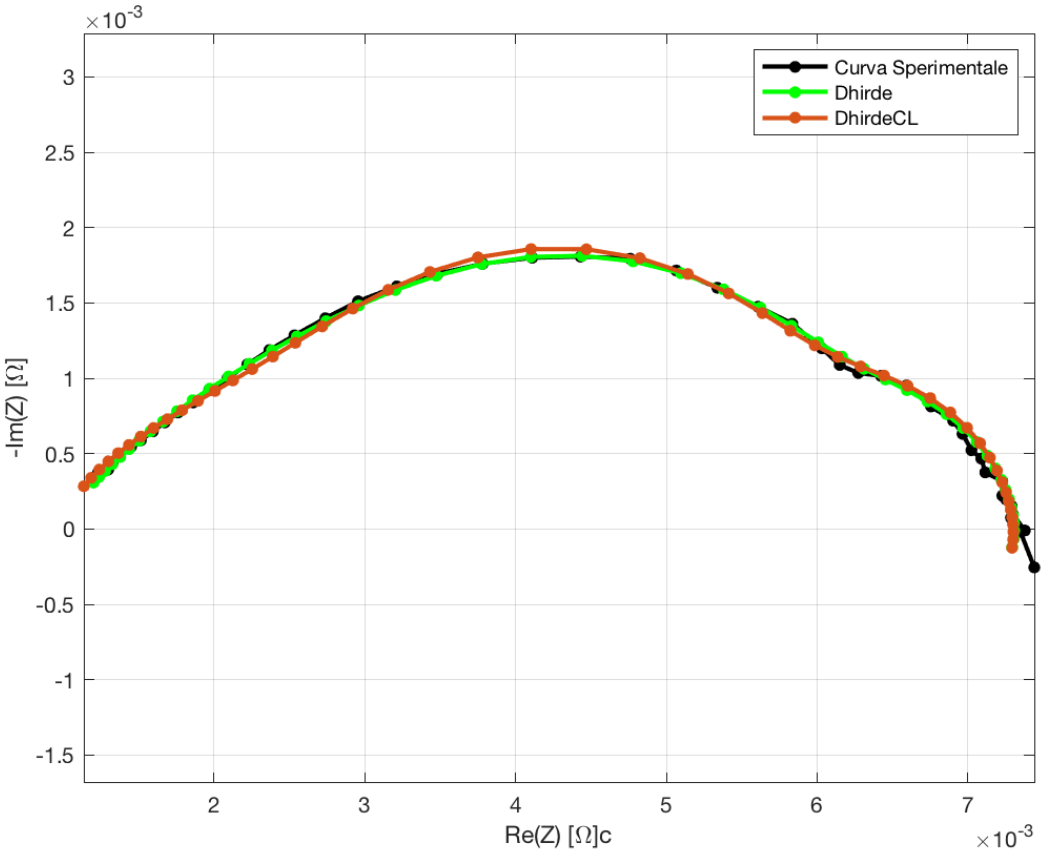

×10^-3
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-Im(Z) [Ω]
2
3
4
5
6
7
Re(Z) [Ω]
×10^-3
Curva Sperimentale
Fouquet
FouquetRC


×10^-3
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-Im(Z) [Ω]
2
3
4
5
6
7
Re(Z) [Ω]c
×10^-3
Curva Sperimentale
Dhirde
DhirdeCL

Fouquet

Fobj = 0.03185;

Romega	Rct	Q	Phi	Rd	Taud
0.0009	0.0037	7.2787	0.6120	0.0028	0.0078

Fouquet + RC

Fobj = 0.02429;

Romega	Rct	Q	Phi	Rd	Taud	R	C
0.0010	0.0031	6.0954	0.6464	0.0012	0.2184	0.0021	5.0646

Dhirde

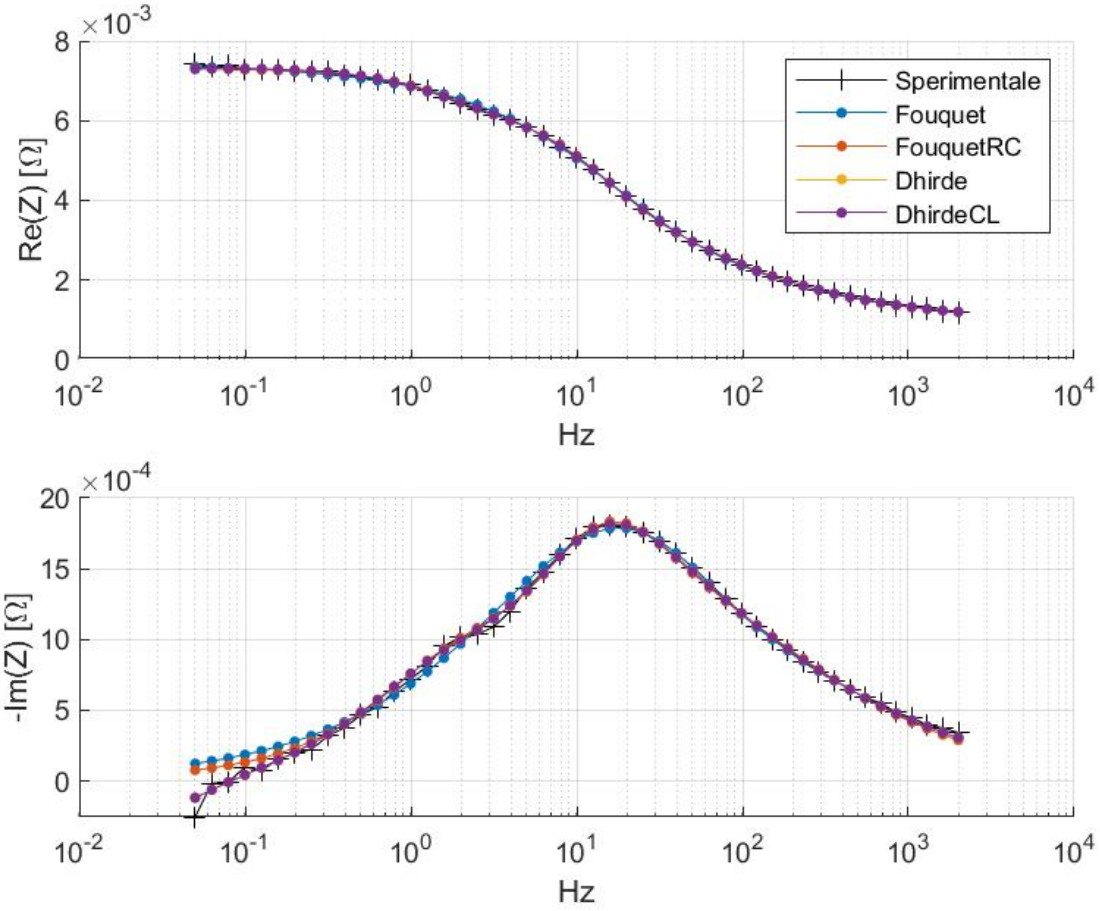
Fobj = **0.01786**;

Romega	Rct1	Rct2	Q1	Q2	Phi1	Phi2	Rd	Taud	L
0.0009	0.0021	0.0034	6.4353	9.9851	0.9521	0.5834	0.0009	0.2986	0.0129

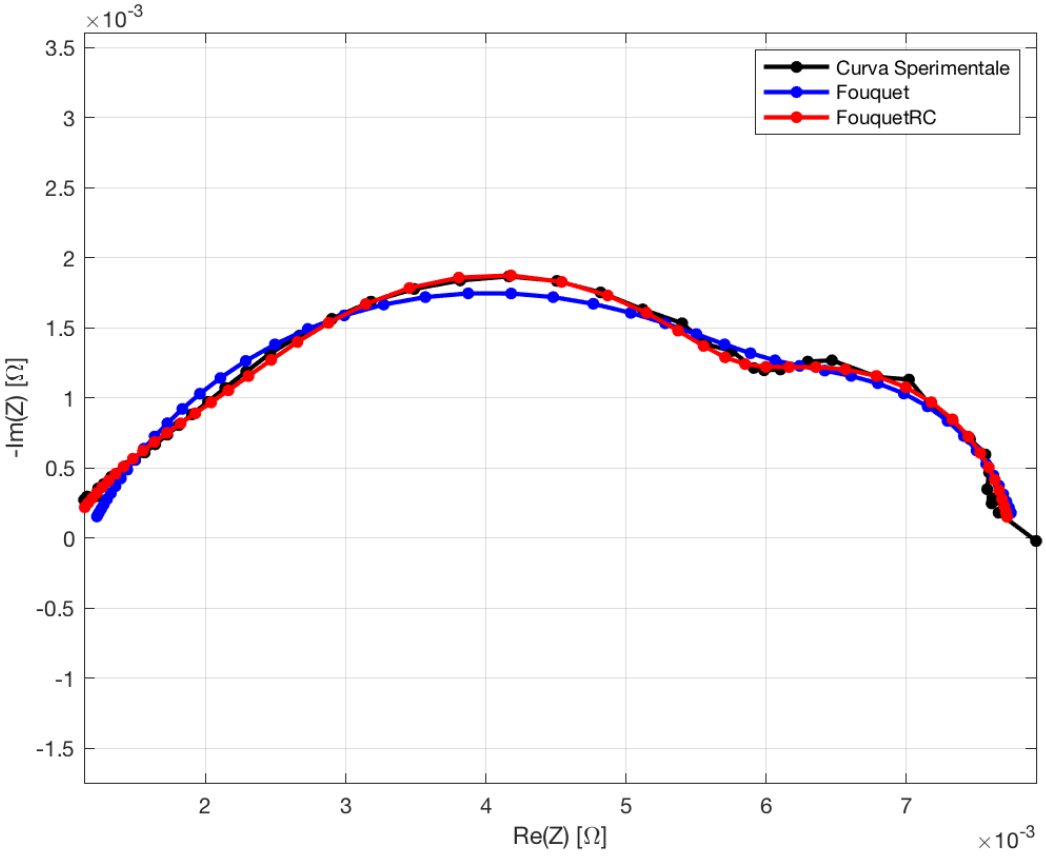
DhirdeCL

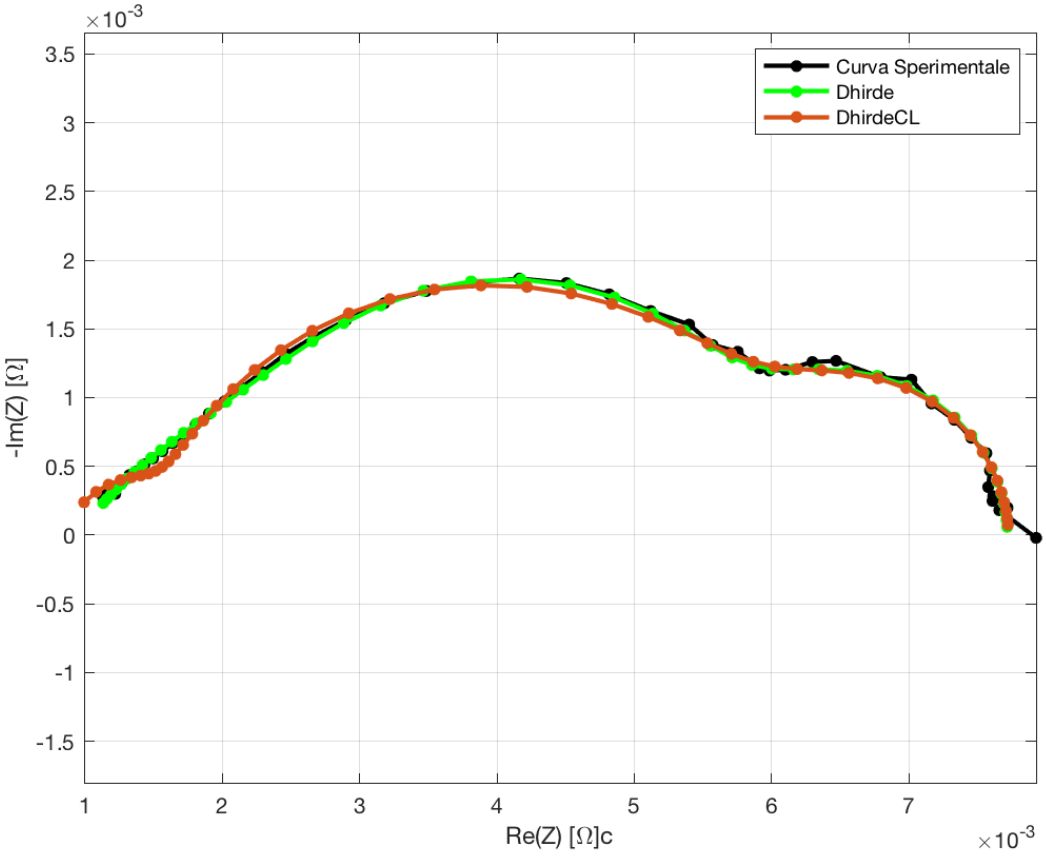
Fobj = 0.02172;

Romega	Rct1	Rct2	Q	Phi	Rd	Taud	Lhf	Llf	C
0.0007	0.0030	0.0023	10.0000	0.5431	0.0013	0.2515	7.72 e-9	0.0247	4.0779


×10^-3
8
6
4
2
0
Re(Z) [Ω]
10^-2
10^-1
10^0
10^1
10^2
10^3
10^4
Hz
Sperimentale
Fouquet
FouquetRC
Dhirde
DhirdeCL
×10^-4
20
15
10
5
0
-Im(Z) [Ω]
10^-2
10^-1
10^0
10^1
10^2
10^3
10^4
Hz

170206_1250_dt46_nc_eis-15a_c02





Fouquet

Fobj = 0.04212;

Romega	Rct	Q	Phi	Rd	Taud
0.0011	0.0054	6.7931	0.7125	0.0013	0.4780

Fouquet + RC

Fobj = 0.02036;

Romega	Rct	Q	Phi	Rd	Taud	R	C
0.0010	0.0020	6.5978	0.6710	0.0022	0.4289	0.0026	4.6975

Dhirde

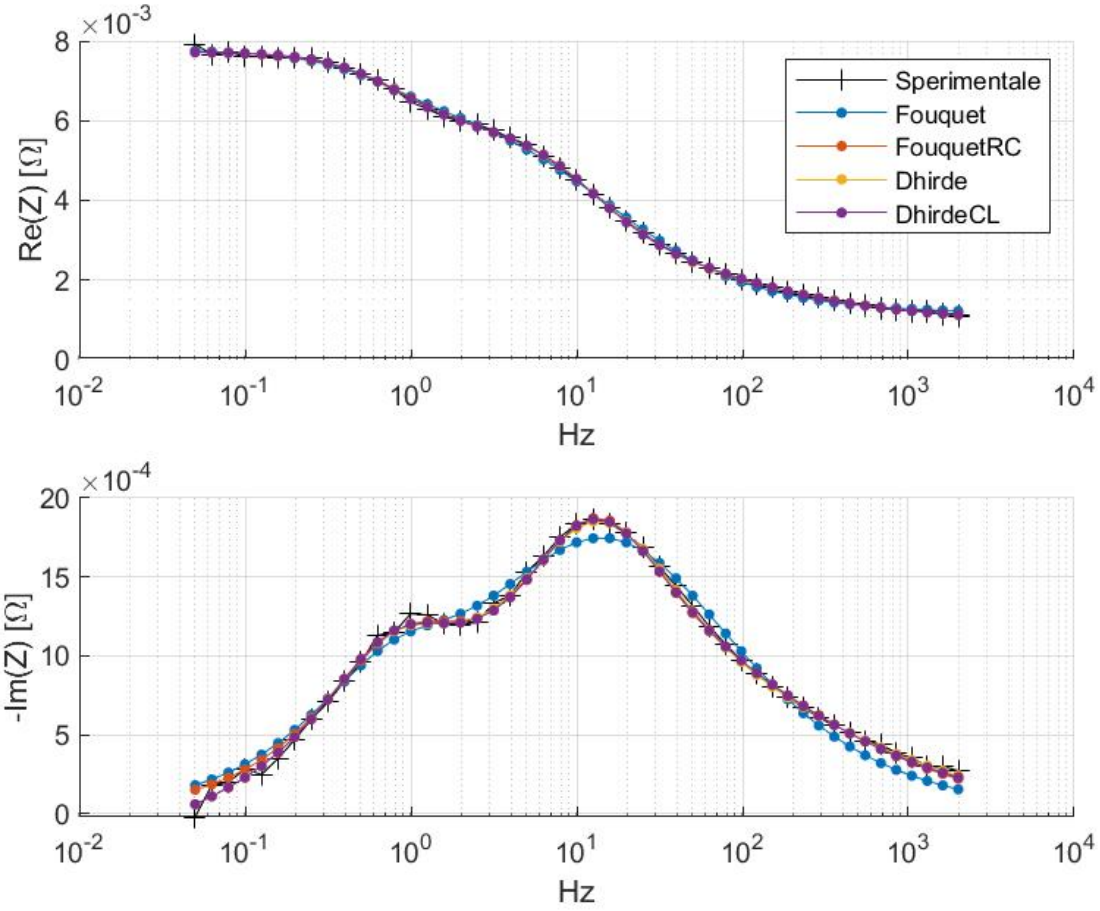
Fobj = **0.01650**;

Romega	Rct1	Rct2	Q1	Q2	Phi1	Phi2	Rd	Taud	L
0.0010	0.0020	0.0026	10.0000	5.1149	0.6253	0.9759	0.0022	0.4956	0.1874

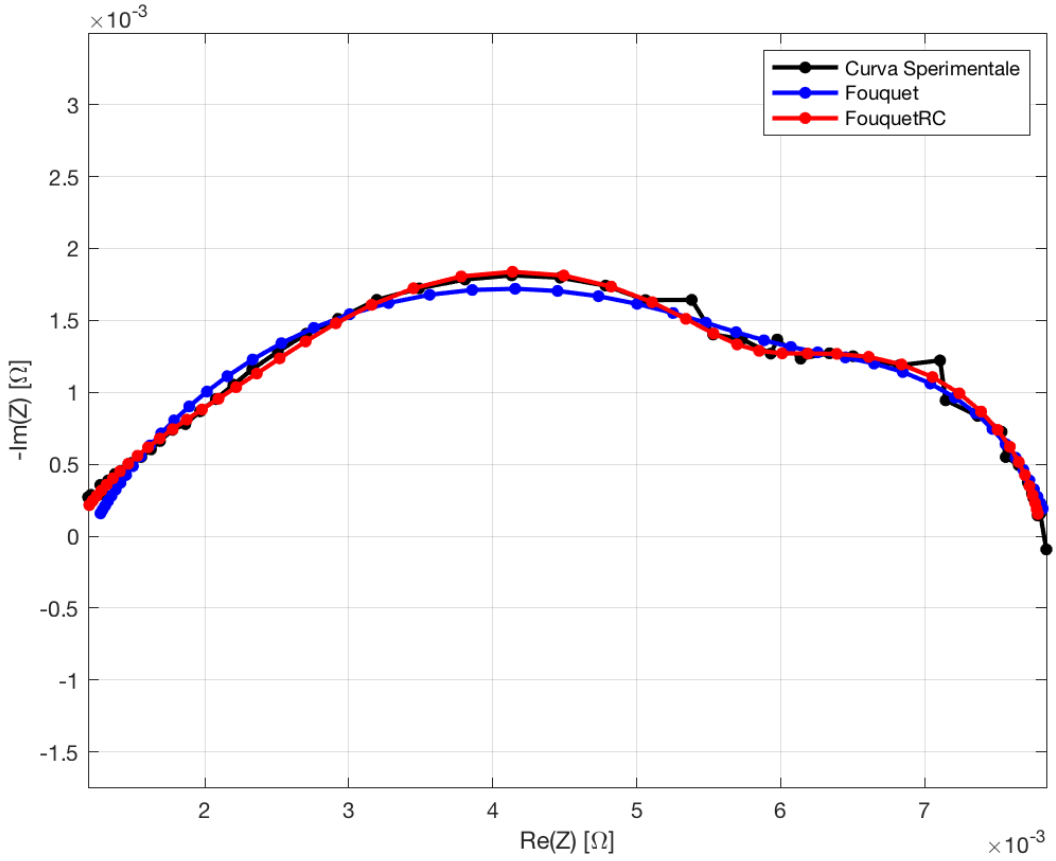
DhirdeCL

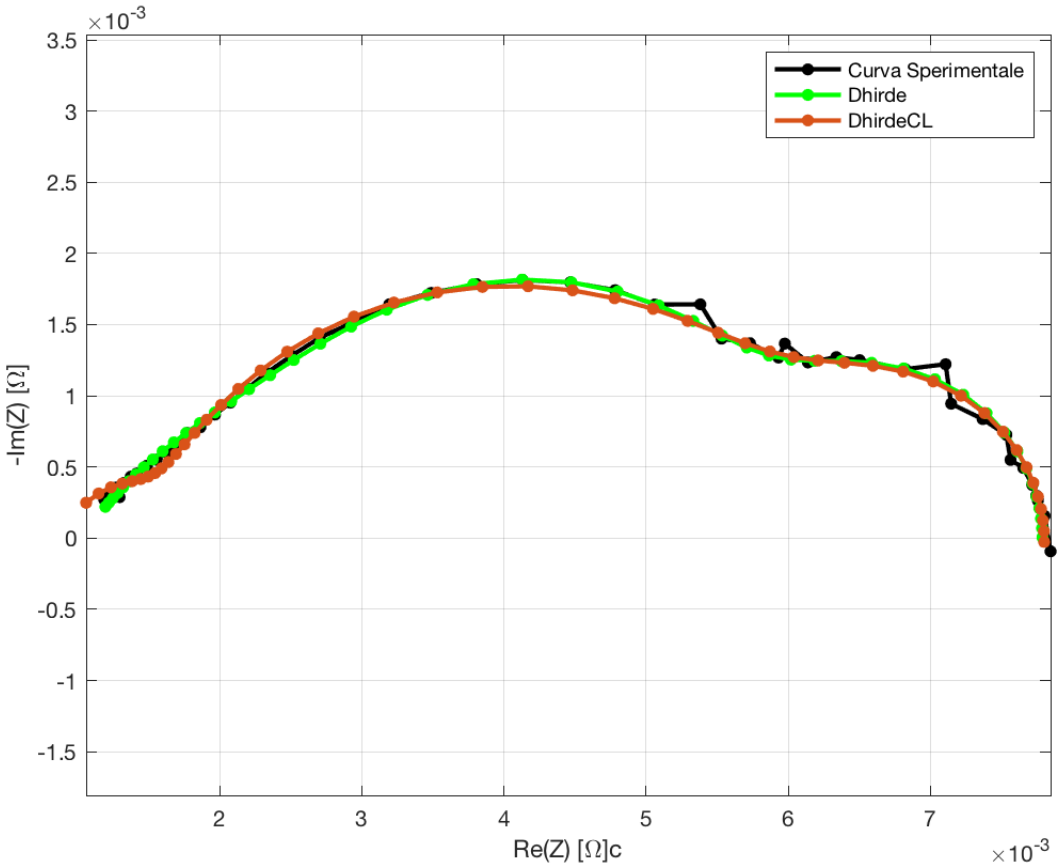
Fobj = 0.02603;

Romega	Rct1	Rct2	Q	Phi	Rd	Taud	Lhf	Llf	C
0.0007	0.0043	0.0008	5.1401	0.8161	0.0020	0.5241	1.85 e-8	0.1763	0.1355


×10^-3
8
6
4
2
0
Re(Z) [Ω]
10^-2
10^-1
10^0
10^1
10^2
10^3
10^4
Hz
Sperimentale
Fouquet
FouquetRC
Dhirde
DhirdeCL
×10^-4
20
15
10
5
0
-Im(Z) [Ω]
10^-2
10^-1
10^0
10^1
10^2
10^3
10^4
Hz

170206_1250_dt46_nc_eis-15a_c03





Fouquet

Fobj = 0.04143;

Romega	Rct	Q	Phi	Rd	Taud
0.0012	0.0054	7.5936	0.6961	0.0013	0.4472

Fouquet + RC

Fobj = 0.02401;

Romega	Rct	Q	Phi	Rd	Taud	R	C
0.0011	0.0021	6.7467	0.6712	0.0022	0.4149	0.0024	5.3801

Dhirde

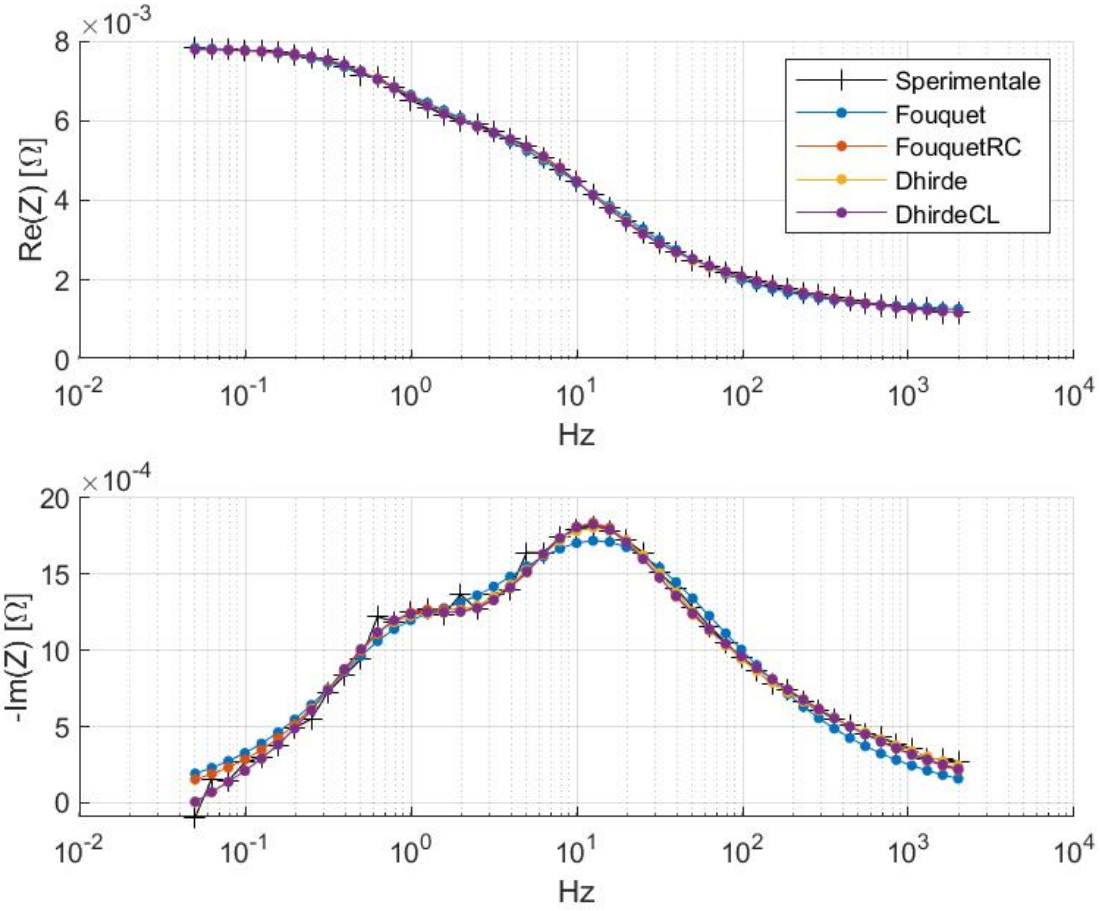
Fobj = **0.02316**;

Romega	Rct1	Rct2	Q1	Q2	Phi1	Phi2	Rd	Taud	L
0.0010	0.0021	0.0025	10.0000	6.3142	0.6346	0.9650	0.0022	0.5003	0.1105

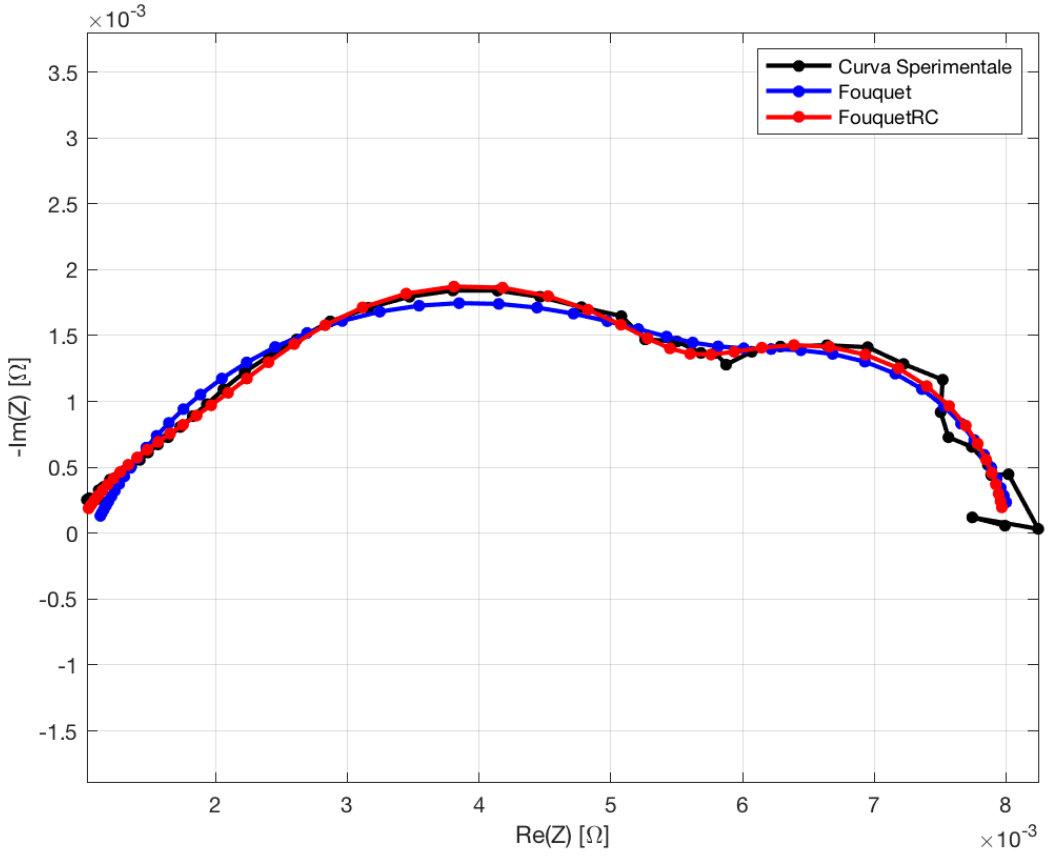
DhirdeCL

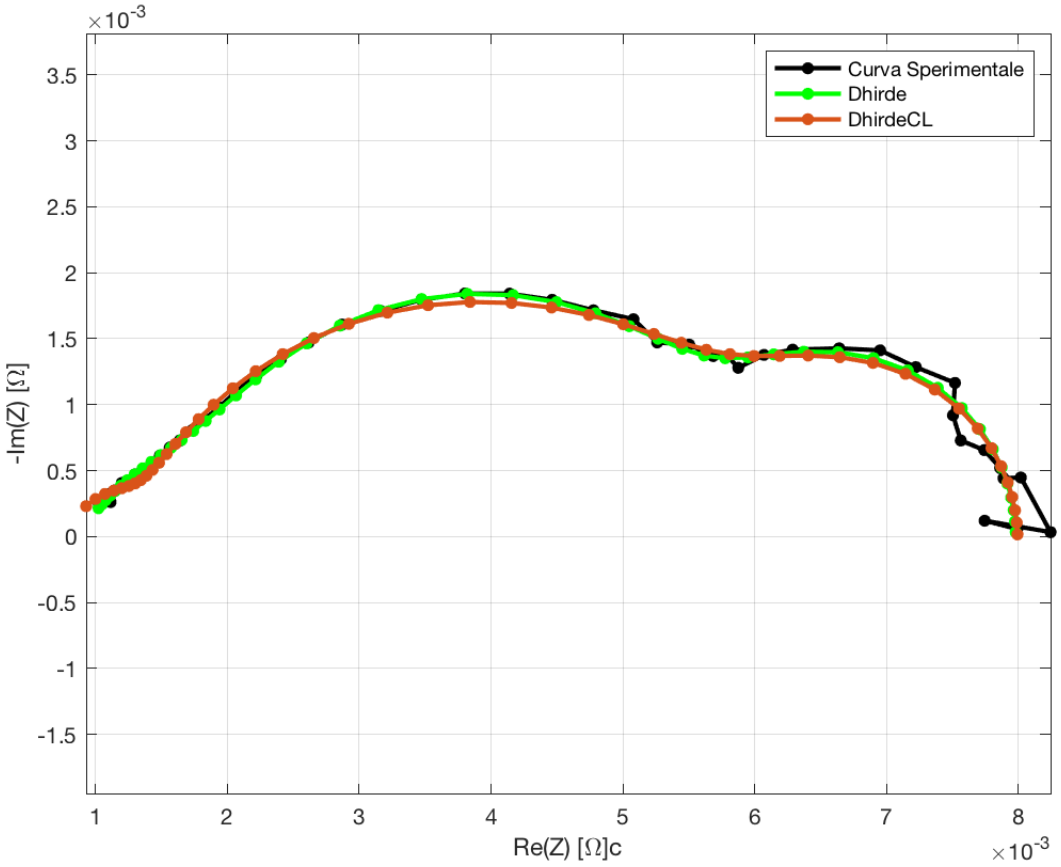
Fobj = 0.02855;

Romega	Rct1	Rct2	Q	Phi	Rd	Taud	Lhf	Llf	C
0.0007	0.0045	0.0007	6.2746	0.7765	0.0019	0.5451	1.81 e-8	0.0618	0.1232


×10^-3
8
6
4
2
0
Re(Z) [Ω]
10^-2
10^-1
10^0
10^1
10^2
10^3
10^4
Hz
Sperimentale
Fouquet
FouquetRC
Dhirde
DhirdeCL
×10^-4
20
15
10
5
0
-Im(Z) [Ω]
10^-2
10^-1
10^0
10^1
10^2
10^3
10^4
Hz

170206_1250_dt46_nc_eis-15a_c04





Fouquet

Fobj = 0.05131;

Romega	Rct	Q	Phi	Rd	Taud
0.0011	0.0052	7.1762	0.7244	0.0019	0.5239

Fouquet + RC

Fobj = 0.03303;

Romega	Rct	Q	Phi	Rd	Taud	R	C
0.0009	0.0017	5.2613	0.7181	0.0028	0.5029	0.0026	5.0937

Dhirde

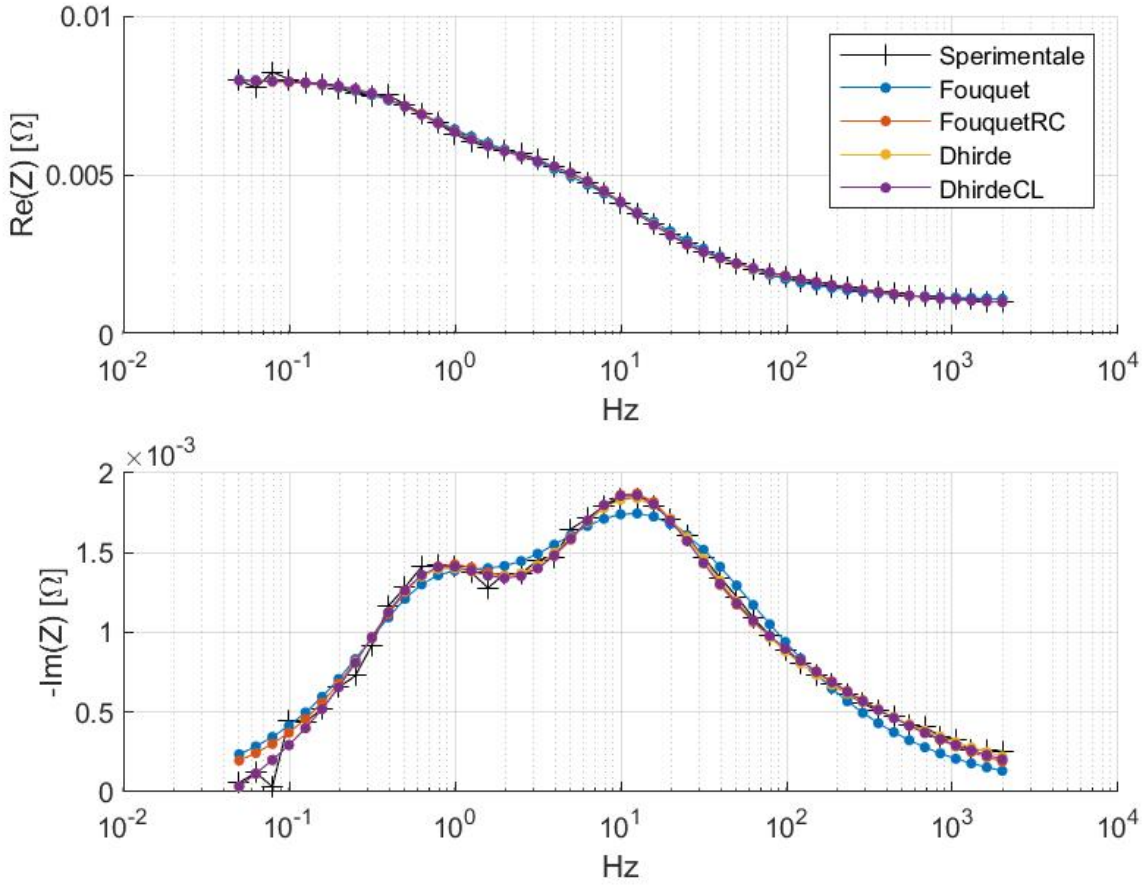
Fobj = **0.02469**;

Romega	Rct1	Rct2	Q1	Q2	Phi1	Phi2	Rd	Taud	L
0.0009	0.0033	0.0011	5.6572	6.5154	0.9078	0.6926	0.0027	0.5886	0.1469

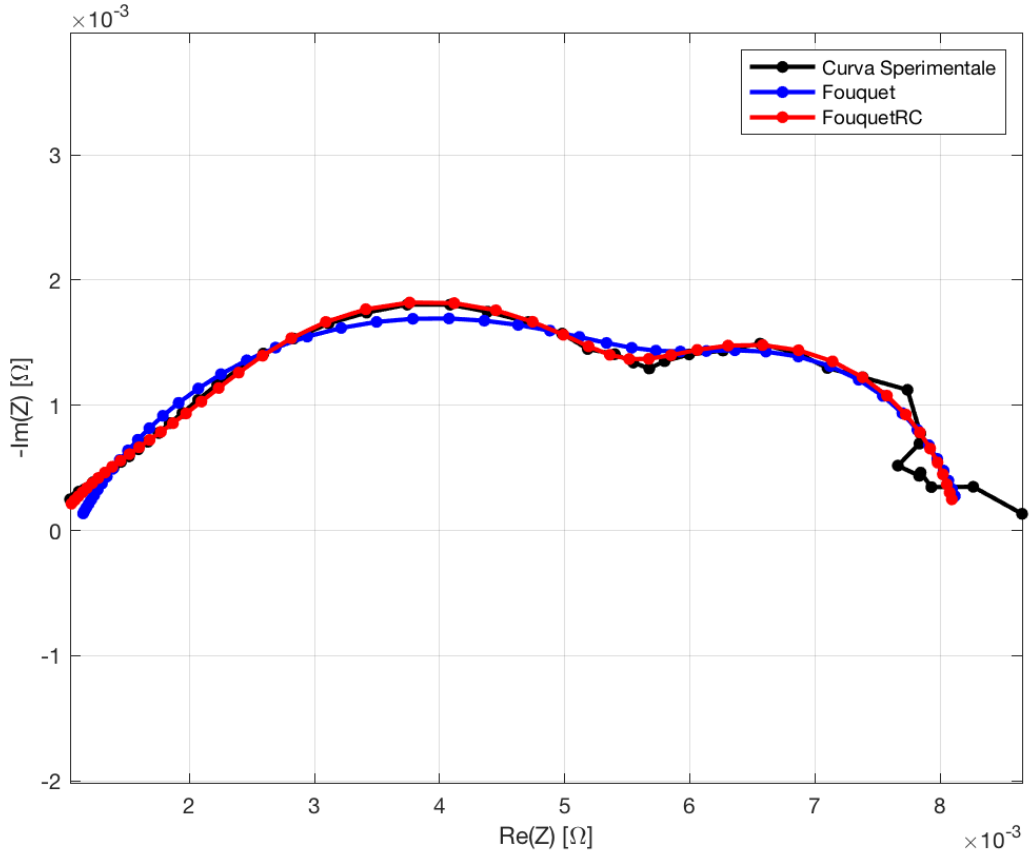
DhirdeCL

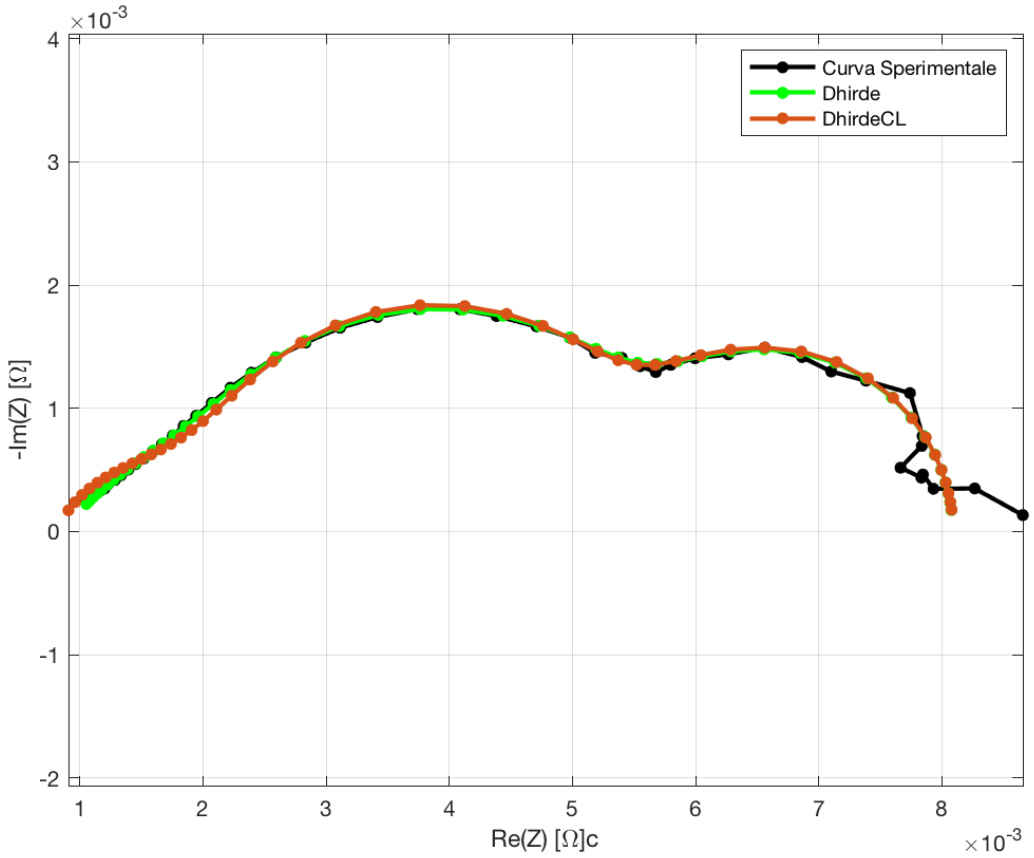
Fobj = 0.03090;

Romega	Rct1	Rct2	Q	Phi	Rd	Taud	Lhf	Llf	C
0.0006	0.0045	0.0006	7.1543	0.7661	0.0023	0.6390	1.32 e-8	0.0864	0.1625


0.01
0.005
0
Re(Z) [Ω]
Sperimentale
Fouquet
FouquetRC
Dhirde
DhirdeCL
10-2
10-1
100
101
102
103
104
Hz
×10-3
2
1.5
1
0.5
0
-Im(Z) [Ω]
10-2
10-1
100
101
102
103
104
Hz

170206_1250_dt46_nc_eis-15a_c05





Fouquet

Fobj = 0.04892;

Romega	Rct	Q	Phi	Rd	Taud
0.0011	0.0051	8.0417	0.7075	0.0020	0.5715

Fouquet + RC

Fobj = 0.02836;

Romega	Rct	Q	Phi	Rd	Taud	R	C
0.0009	0.0019	9.0576	0.6325	0.0029	0.5188	0.0024	5.5124

Dhirde

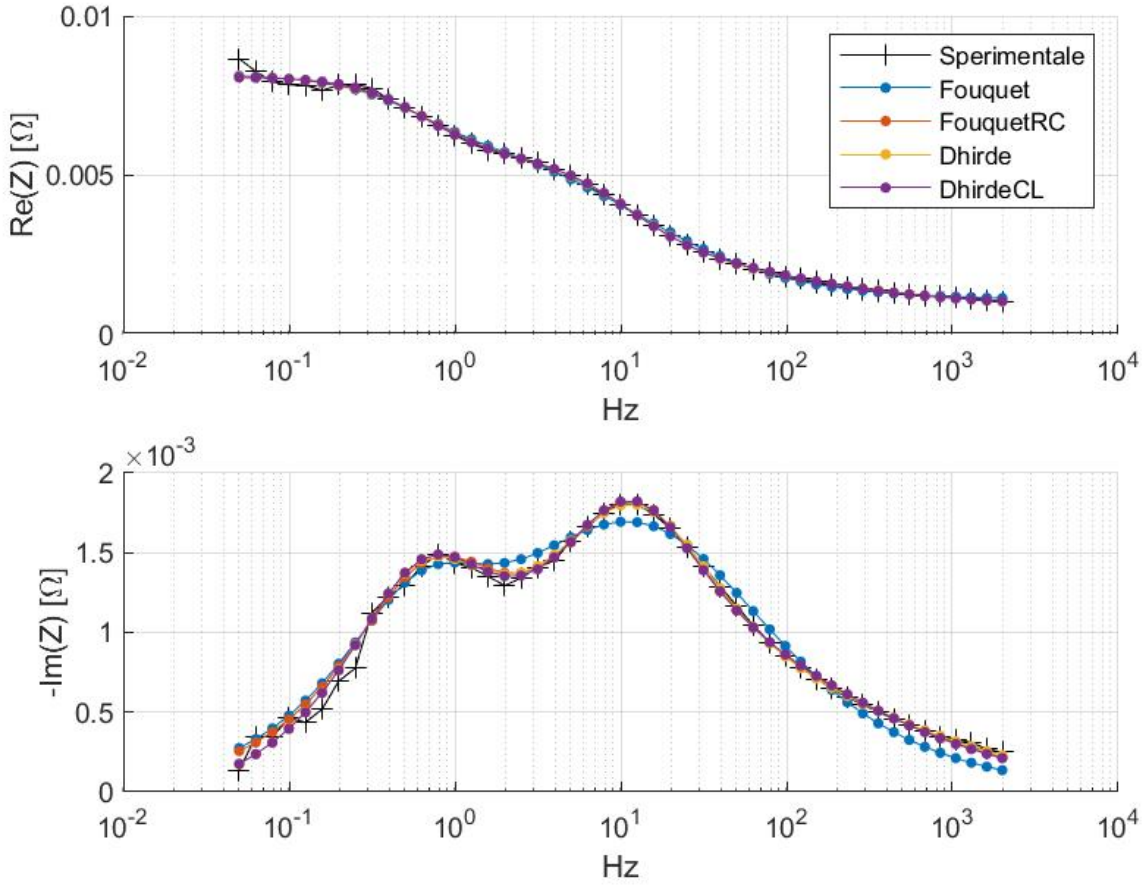
Fobj = **0.02631**;

Romega	Rct1	Rct2	Q1	Q2	Phi1	Phi2	Rd	Taud	L
0.0009	0.0014	0.0029	9.9997	5.8385	0.6299	0.9428	0.0030	0.6153	0.6866

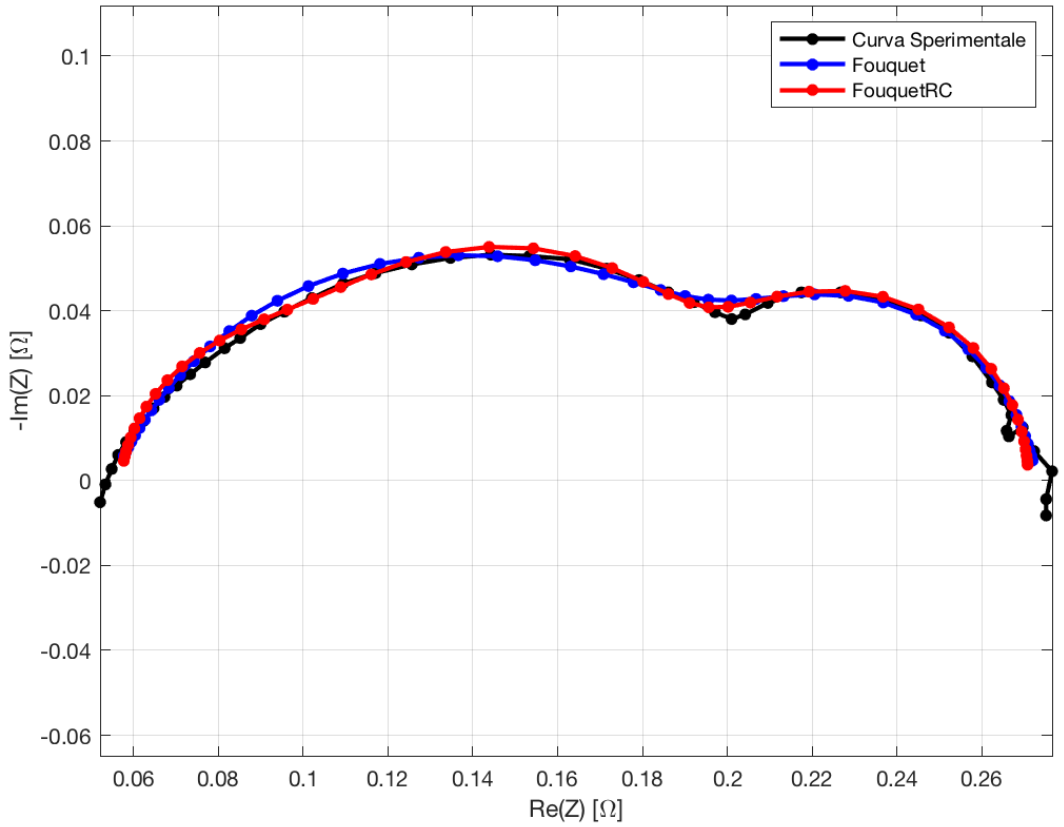
DhirdeCL

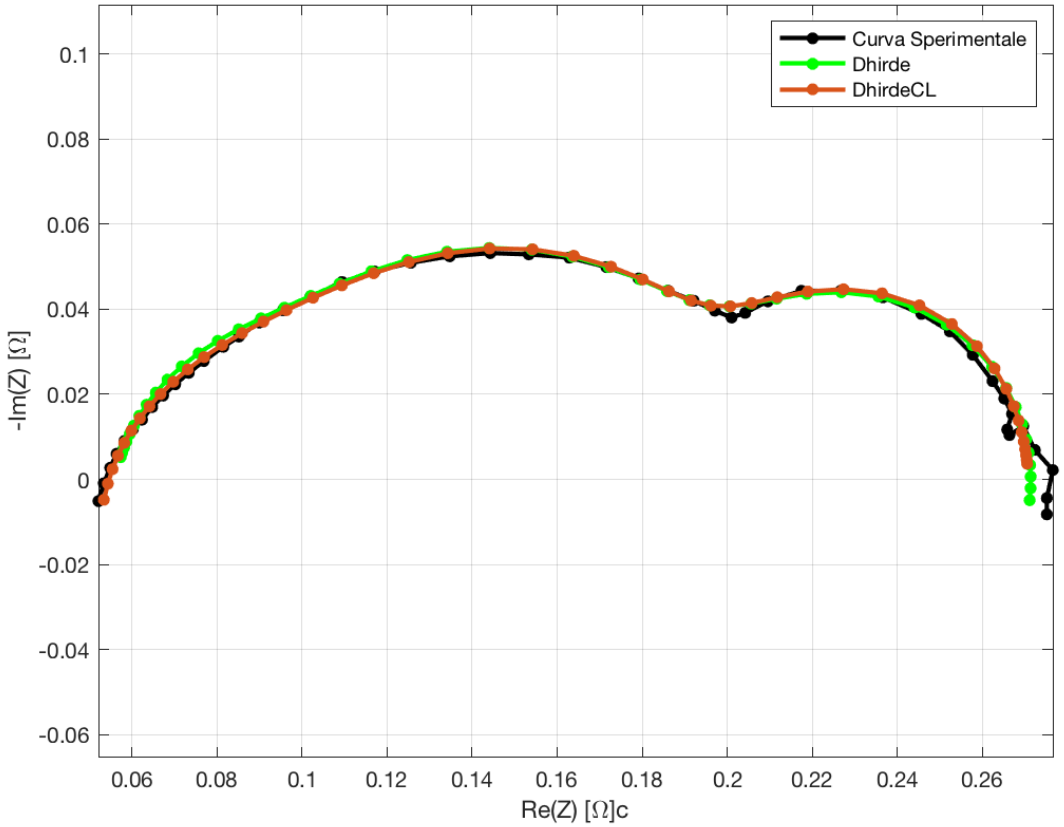
Fobj = 0.03055;

Romega	Rct1	Rct2	Q	Phi	Rd	Taud	Lhf	Llf	C
0.0004	0.0021	0.0026	10.0000	0.5117	0.0031	0.5947	1.68 e-8	0.7271	4.9887


0.01
0.005
0
Re(Z) [Ω]
Sperimentale
Fouquet
FouquetRC
Dhirde
DhirdeCL
10-2
10-1
100
101
102
103
104
Hz
×10-3
2
1.5
1
0.5
0
-Im(Z) [Ω]
10-2
10-1
100
101
102
103
104
Hz

170206_1330_dt46_nc_eis-25a_c00





Fouquet

Fobj = 0.04494;

Romega	Rct	Q	Phi	Rd	Taud
0.0551	0.1486	0.1285	0.7516	0.0694	0.3317

Fouquet + RC

Fobj = 0.03616;

Romega	Rct	Q	Phi	Rd	Taud	R	C
0.0571	0.0498	0.0321	0.9471	0.0911	0.3474	0.0730	0.1203

Dhirde

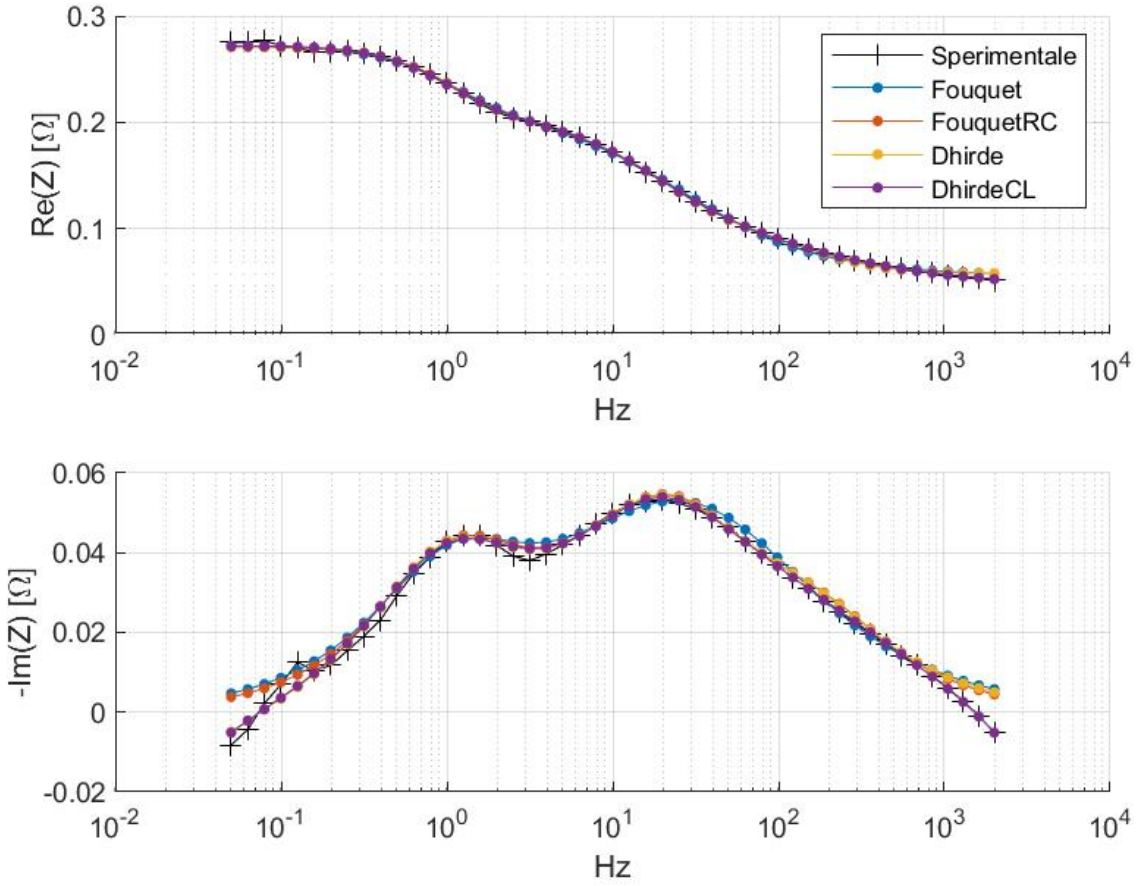
Fobj = 0.03816;

Romega	Rct1	Rct2	Q1	Q2	Phi1	Phi2	Rd	Taud	L
0.0557	0.0392	0.0873	0.0485	0.1331	0.9254	0.9328	0.0893	0.3817	2.8737

DhirdeCL

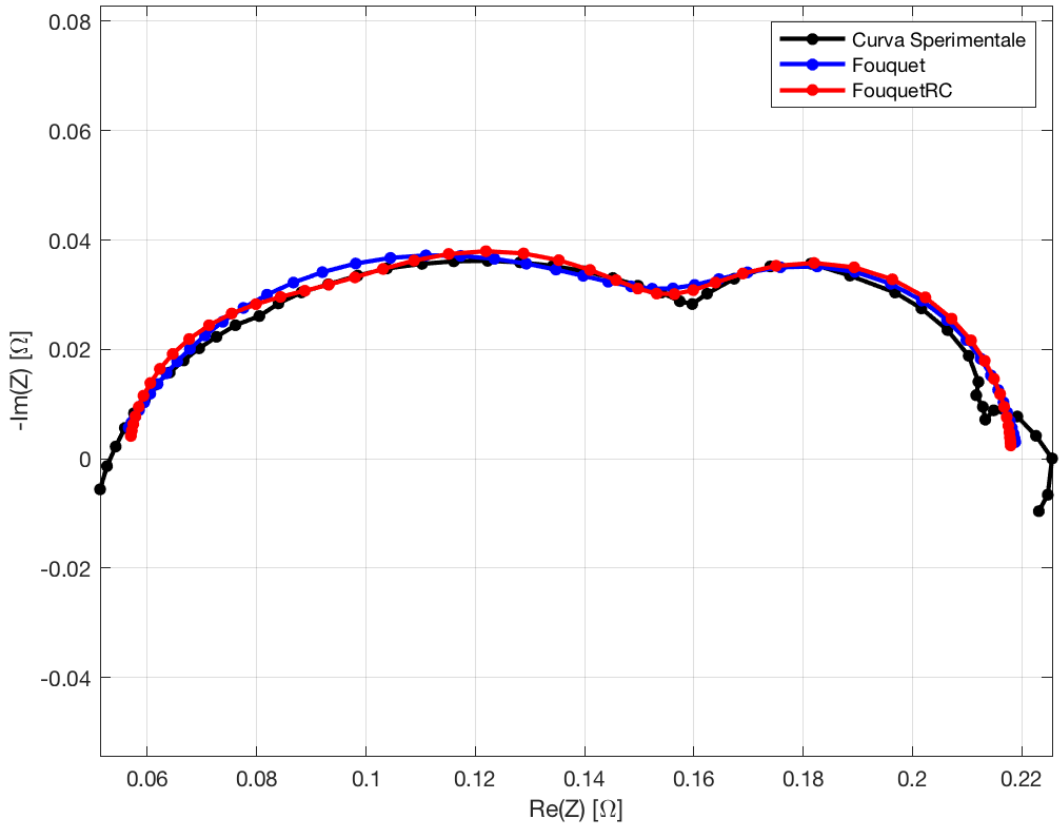
Fobj = **0.02763**;

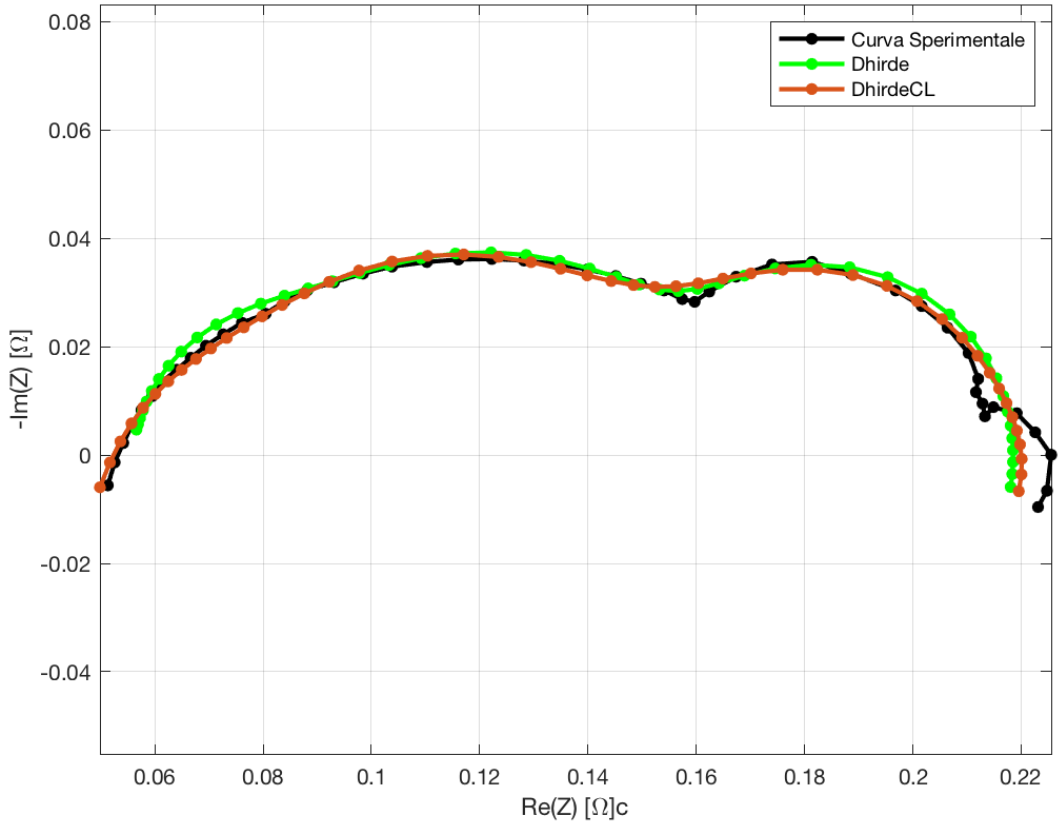
Romega	Rct1	Rct2	Q	Phi	Rd	Taud	Lhf	Llf	C
0.0470	0.0842	0.1397	0.2015	0.6915	0.0662	0.0237	1.07 e-6	0.0158	1.3187


Sperimentale
Fouquet
FouquetRC
Dhirde
DhirdeCL
Re(Z) [Ω]
0.3
0.2
0.1
0
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
Hz

-Im(Z) [Ω]
0.06
0.04
0.02
0
-0.02
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
Hz

170206_1410_dt46_nc_eis-40a_c00





Fouquet

Fobj = 0.06463;

Romega	Rct	Q	Phi	Rd	Taud
0.0538	0.1032	0.1295	0.7507	0.0625	0.2616

Fouquet + RC

Fobj = 0.05809;

Romega	Rct	Q	Phi	Rd	Taud	R	C
0.0566	0.0387	0.0218	1.0000	0.0760	0.2816	0.0467	0.1437

Dhirde

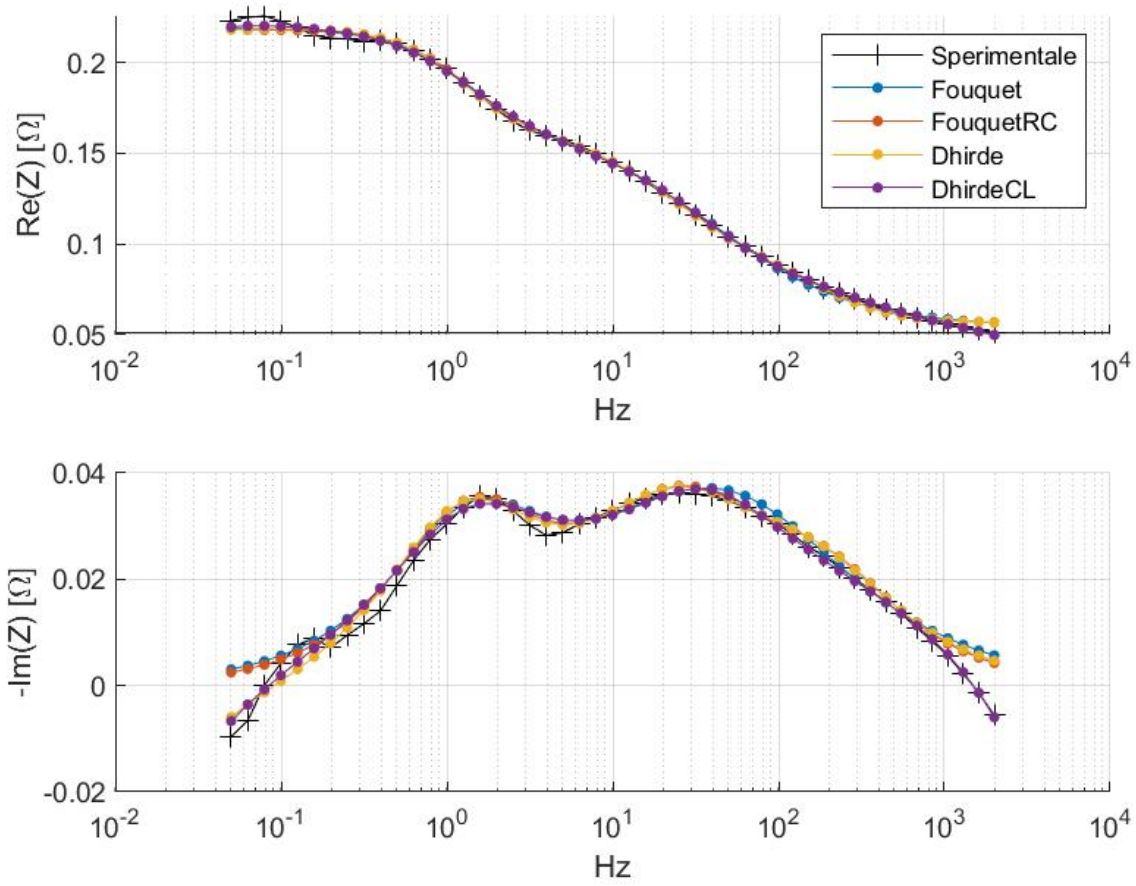
Fobj = 0.05594;

Romega	Rct1	Rct2	Q1	Q2	Phi1	Phi2	Rd	Taud	L
0.0553	0.0274	0.0625	0.0304	0.1656	1.0000	0.8951	0.0734	0.3096	2.0036

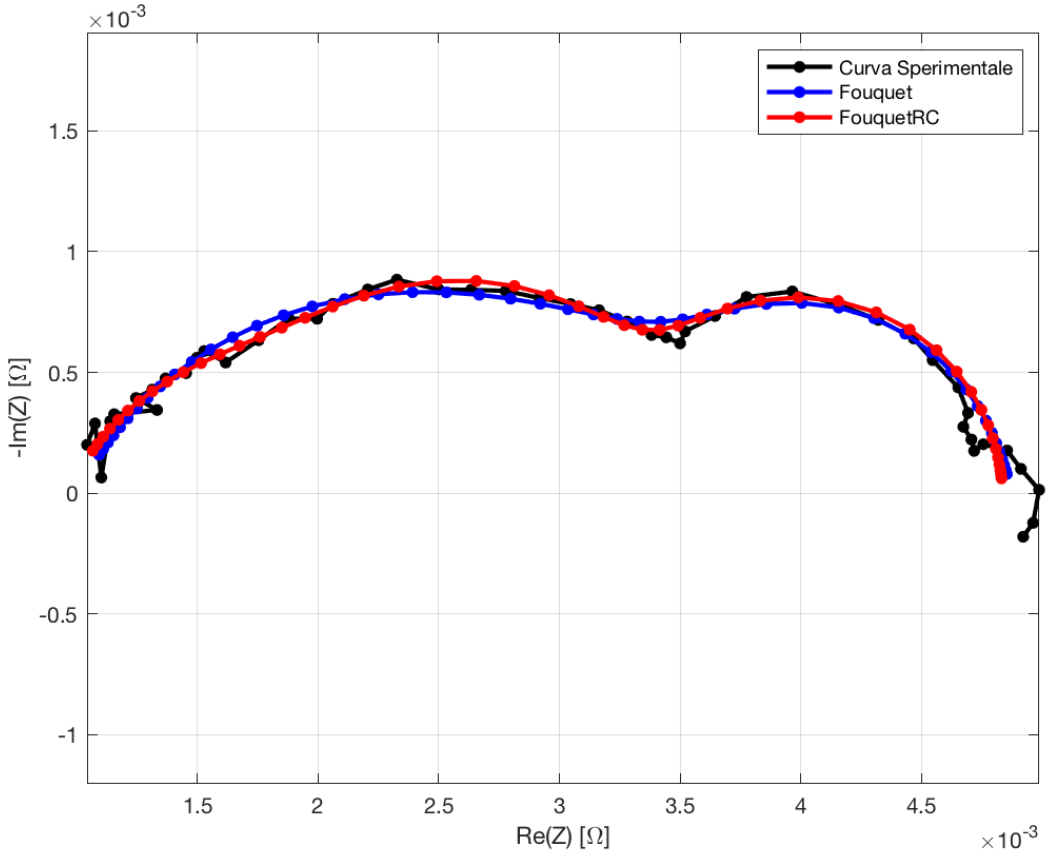
DhirdeCL

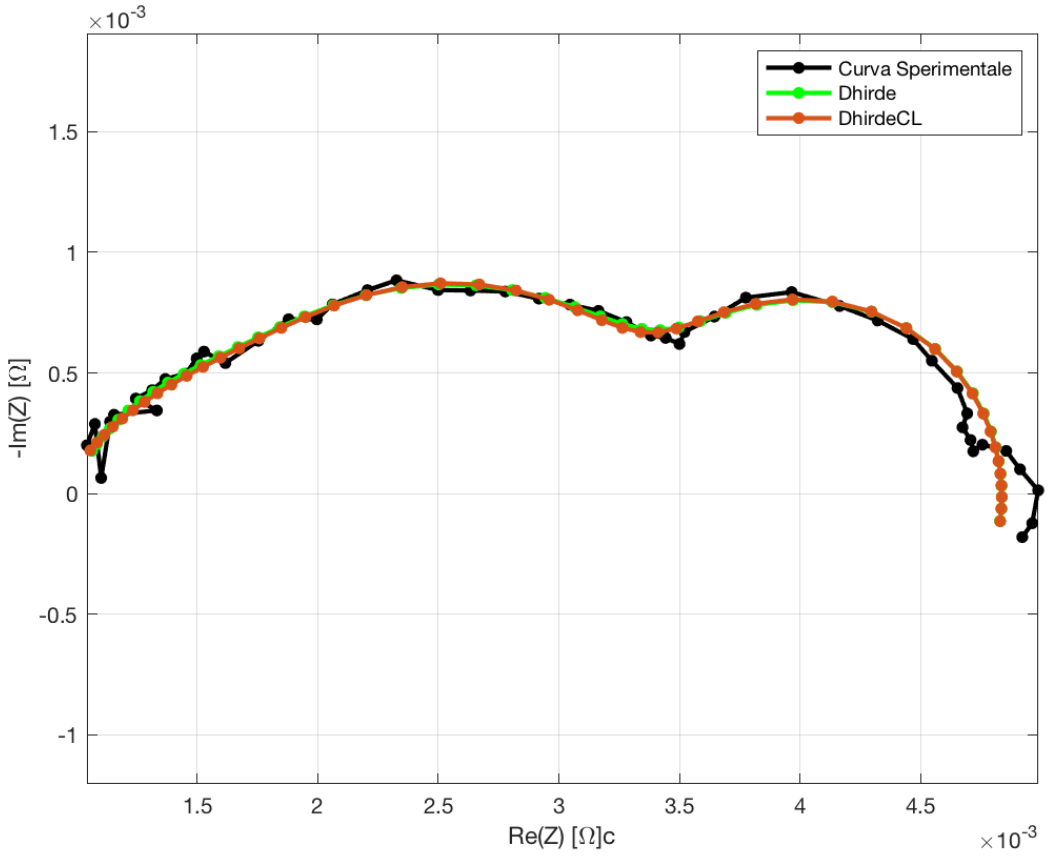
Fobj = **0.04526**;

Romega	Rct1	Rct2	Q	Phi	Rd	Taud	Lhf	Llf	C
0.0237	0.1248	0.0288	0.8551	0.3702	0.0518	0.2850	1.56 e-6	0.6544	0.1495


Sperimentale
Fouquet
FouquetRC
Dhirde
DhirdeCL
Re(Z) [Ω]
0.2
0.15
0.1
0.05
10-2
10-1
100
101
102
103
104
Hz
-Im(Z) [Ω]
0.04
0.02
0
-0.02
10-2
10-1
100
101
102
103
104
Hz

170206_1410_dt46_nc_eis-40a_c02





Fouquet

Fobj = 0.06487;

Romega	Rct	Q	Phi	Rd	Taud
0.0010	0.0025	7.0888	0.6993	0.0013	0.2684

Fouquet + RC

Fobj = 0.05630;

Romega	Rct	Q	Phi	Rd	Taud	R	C
0.0010	0.0011	3.3276	0.7760	0.0017	0.2779	0.0010	5.7800

Dhirde

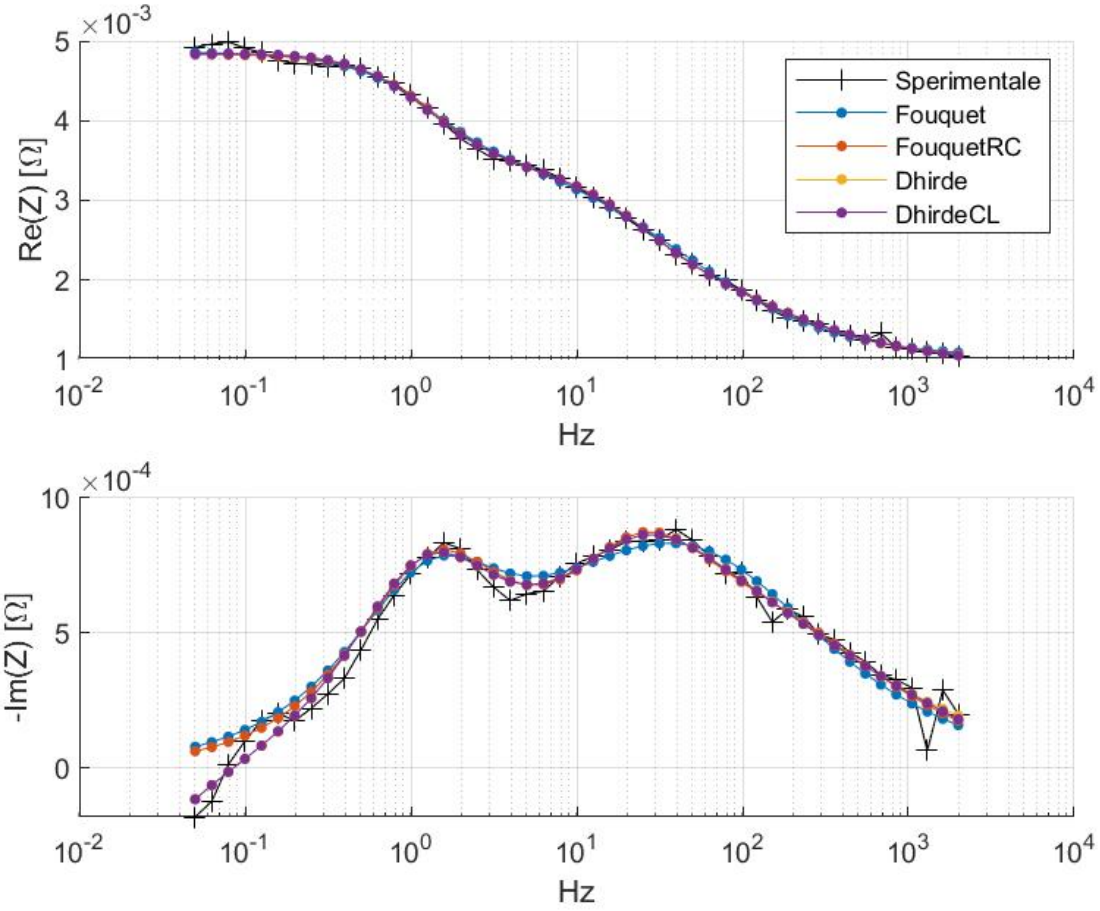
Fobj = **0.05477**;

Romega	Rct1	Rct2	Q1	Q2	Phi1	Phi2	Rd	Taud	L
0.0010	0.0015	0.0007	6.3215	2.9457	0.8905	0.8187	0.0017	0.3132	0.0518

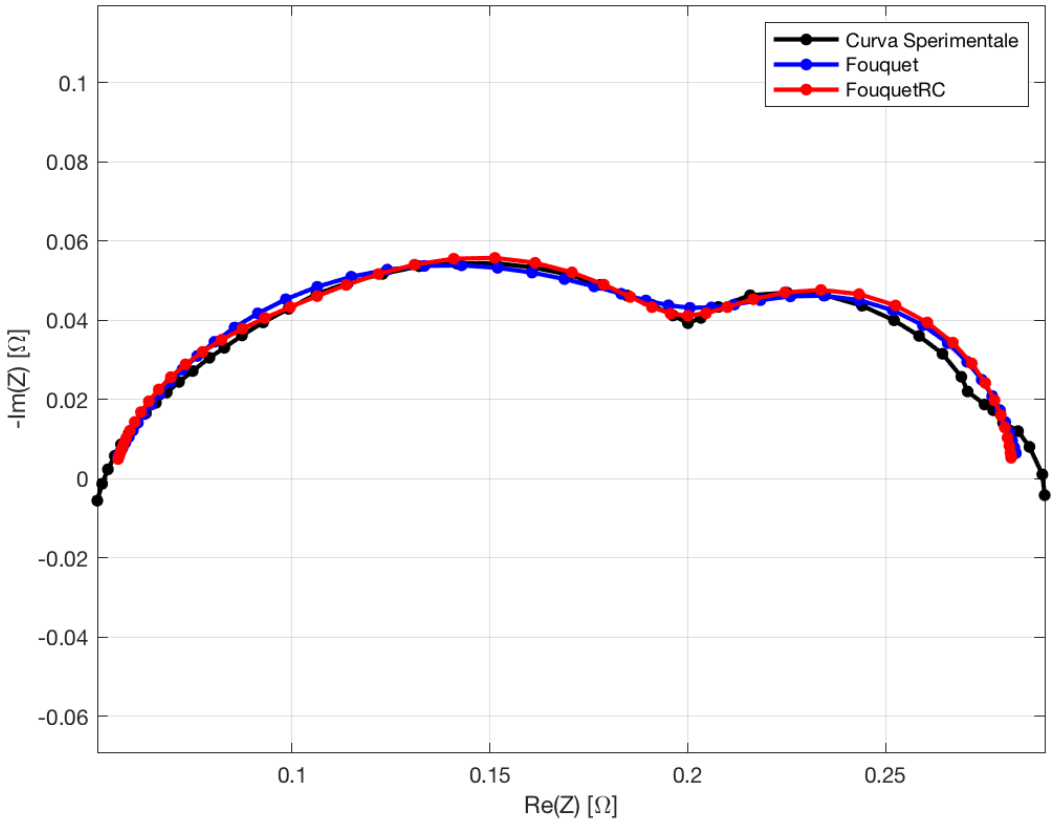
DhirdeCL

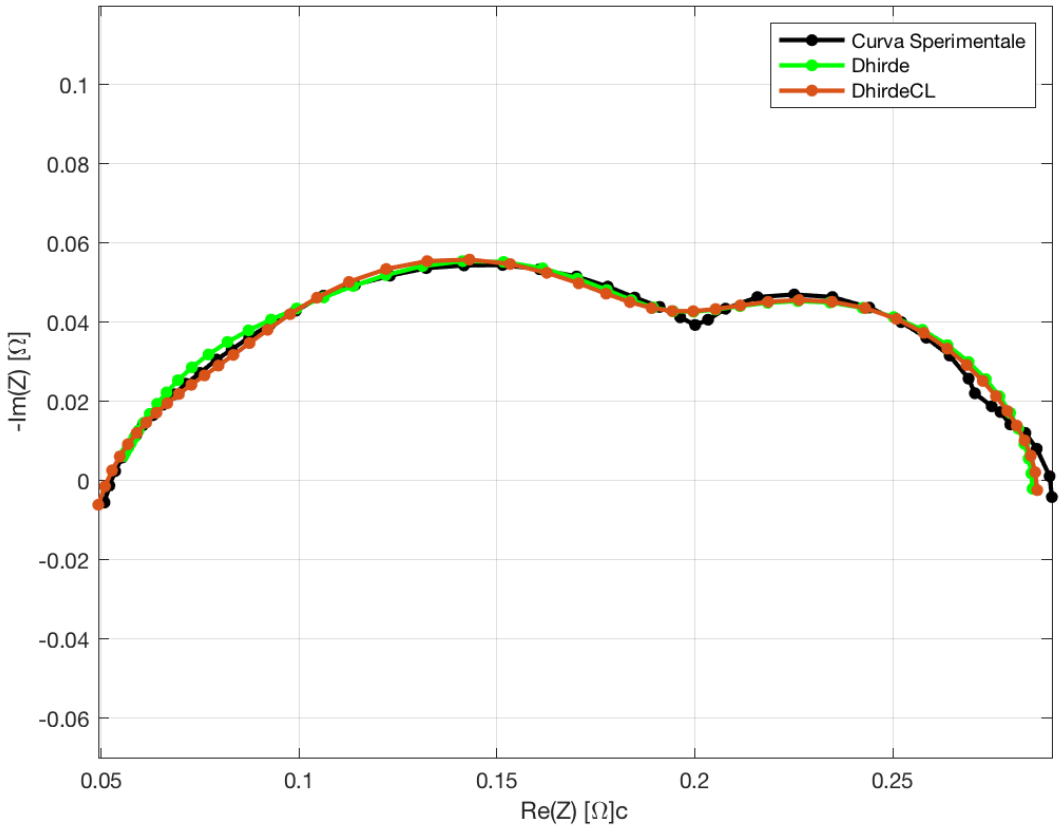
Fobj = 0.05502;

Romega	Rct1	Rct2	Q	Phi	Rd	Taud	Lhf	Llf	C
0.0009	0.0014	0.0009	10.0000	0.6204	0.0017	0.3065	3.14 e-9	0.0505	6.3330


×10^-3
5
4
3
2
1
Re(Z) [Ω]
10^-2
10^-1
10^0
10^1
10^2
10^3
10^4
Hz
Sperimentale
Fouquet
FouquetRC
Dhirde
DhirdeCL
×10^-4
10
5
0
-Im(Z) [Ω]
10^-2
10^-1
10^0
10^1
10^2
10^3
10^4
Hz

170209_1512_dt46_fs-px_eis-25a_c00





Fouquet

Fobj = 0.04216;

Romega	Rct	Q	Phi	Rd	Taud
0.0533	0.1537	0.1416	0.7407	0.0775	0.4419

Fouquet + RC

Fobj = 0.03617;

Romega	Rct	Q	Phi	Rd	Taud	R	C
0.0548	0.0619	0.0572	0.8706	0.0985	0.4446	0.0670	0.1489

Dhirde

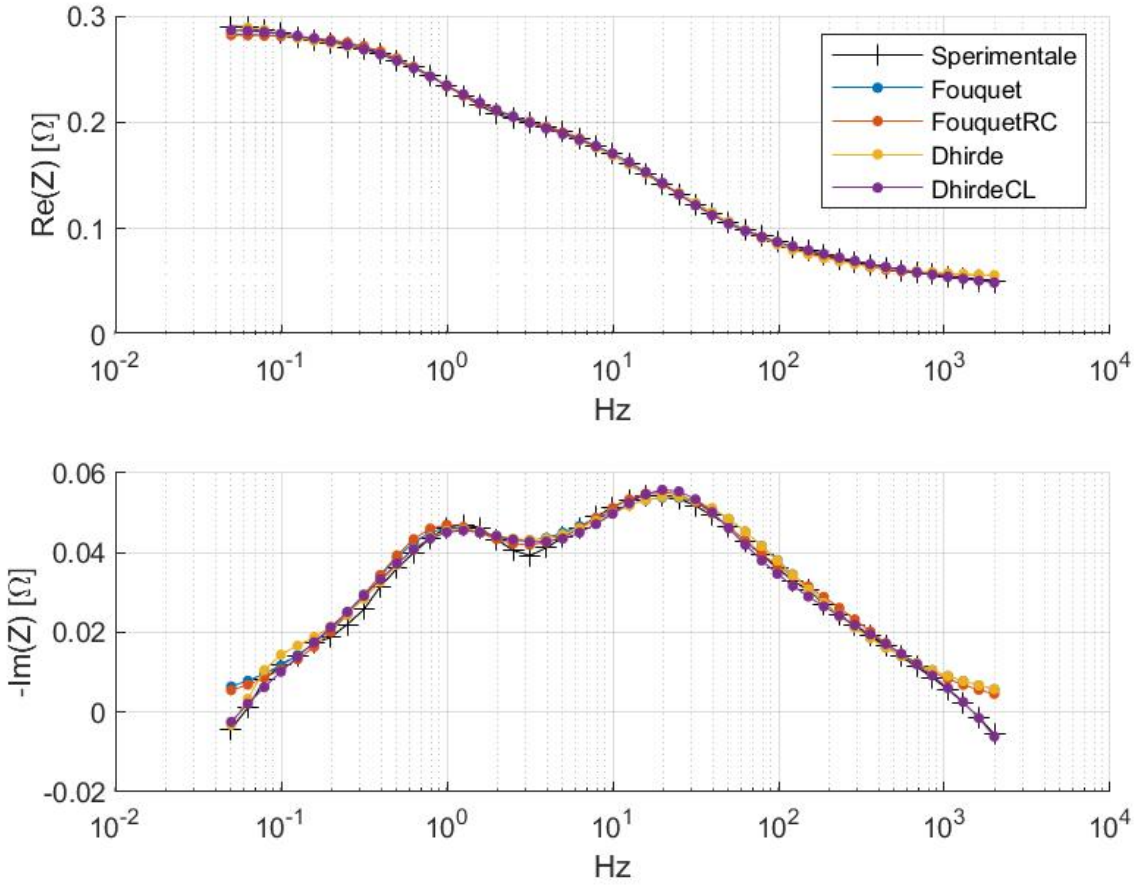
Fobj = 0.03764;

Romega	Rct1	Rct2	Q1	Q2	Phi1	Phi2	Rd	Taud	L
0.0512	0.1039	0.0391	2.1921	0.0654	0.8437	0.9455	0.0951	0.0224	2.6921

DhirdeCL

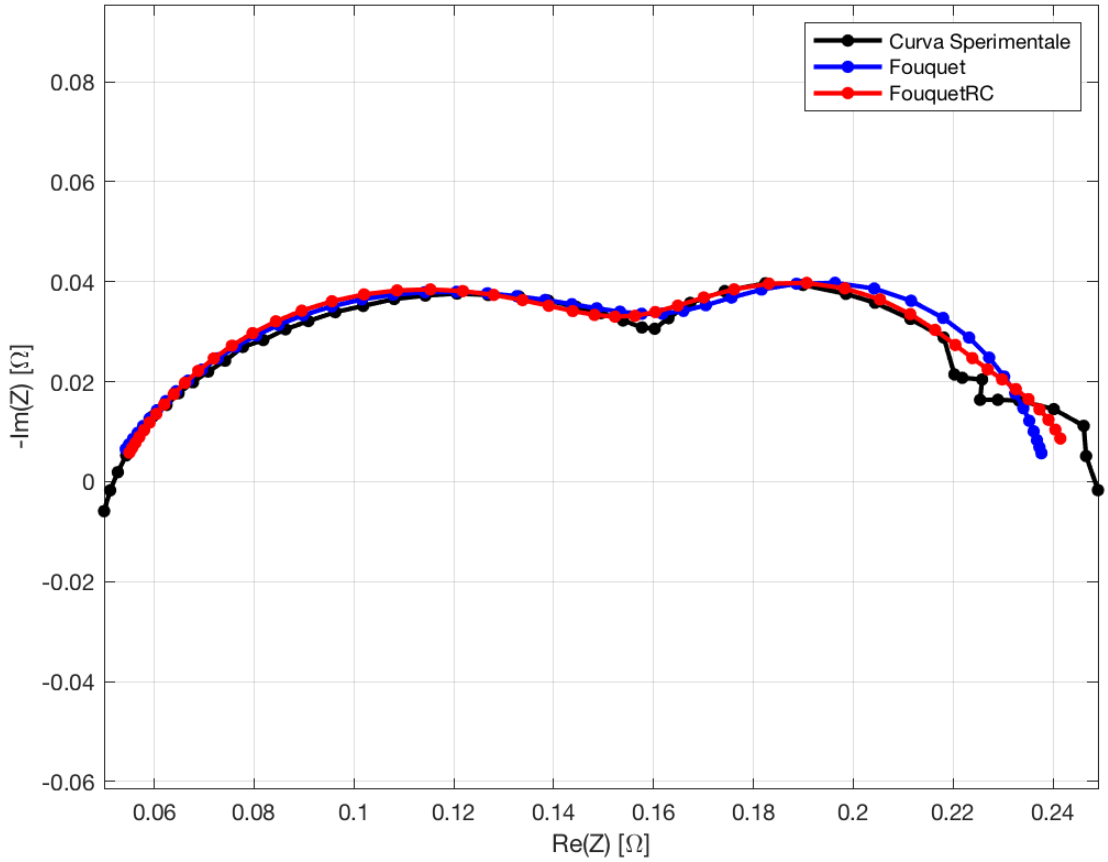
Fobj = **0.02648**;

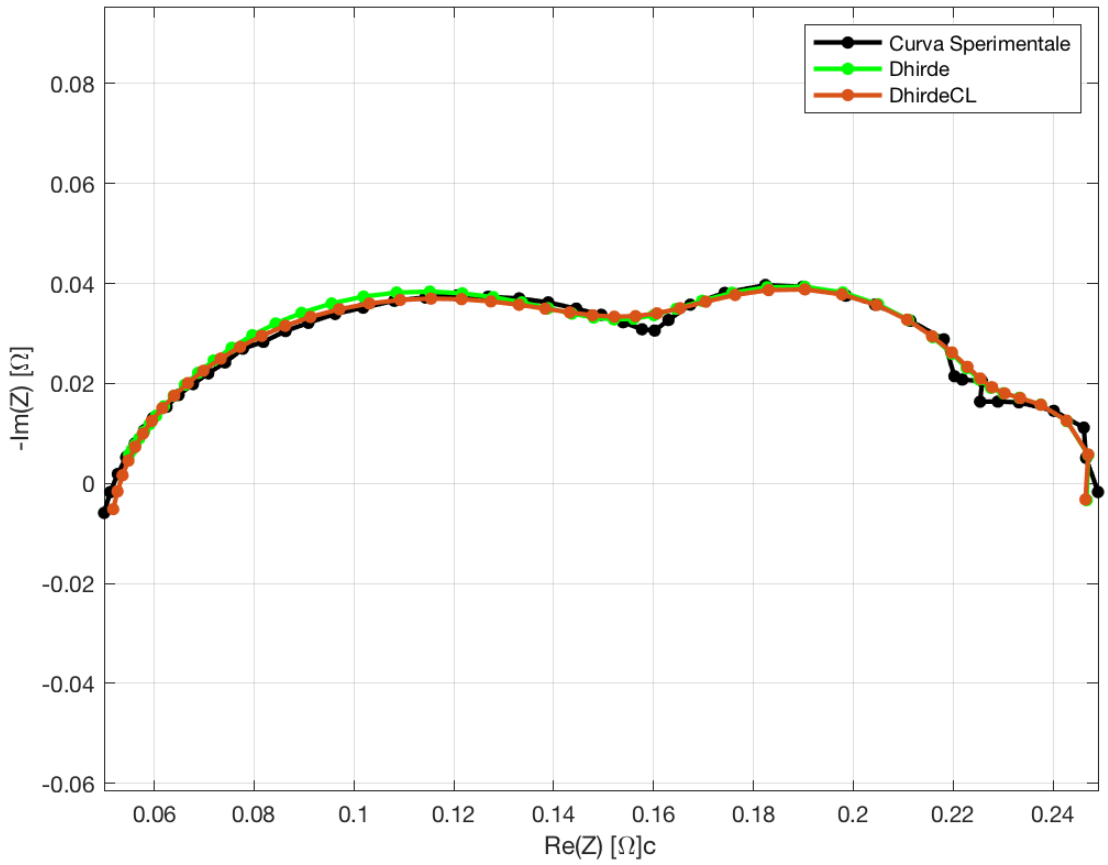
Romega	Rct1	Rct2	Q	Phi	Rd	Taud	Lhf	Llf	C
0.0271	0.1599	0.0474	1.8741	0.3333	0.0809	0.0170	0.0000	1.1890	3.5729


Sperimentale
Fouquet
FouquetRC
Dhirde
DhirdeCL
Re(Z) [Ω]
0.3
0.2
0.1
0
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
Hz

-Im(Z) [Ω]
0.06
0.04
0.02
0
-0.02
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
Hz

170209_1545_dt46_fs-px_eis-40a_c00





Fouquet

Fobj = 0.06718;

Romega	Rct	Q	Phi	Rd	Taud
0.0503	0.1177	0.1957	0.6860	0.0714	0.3983

Fouquet + RC

Fobj = 0.06260;

Romega	Rct	Q	Phi	Rd	Taud	R	C
0.0520	0.1138	0.1635	0.7226	0.0214	2.5208	0.0566	2.3729

Dhirde

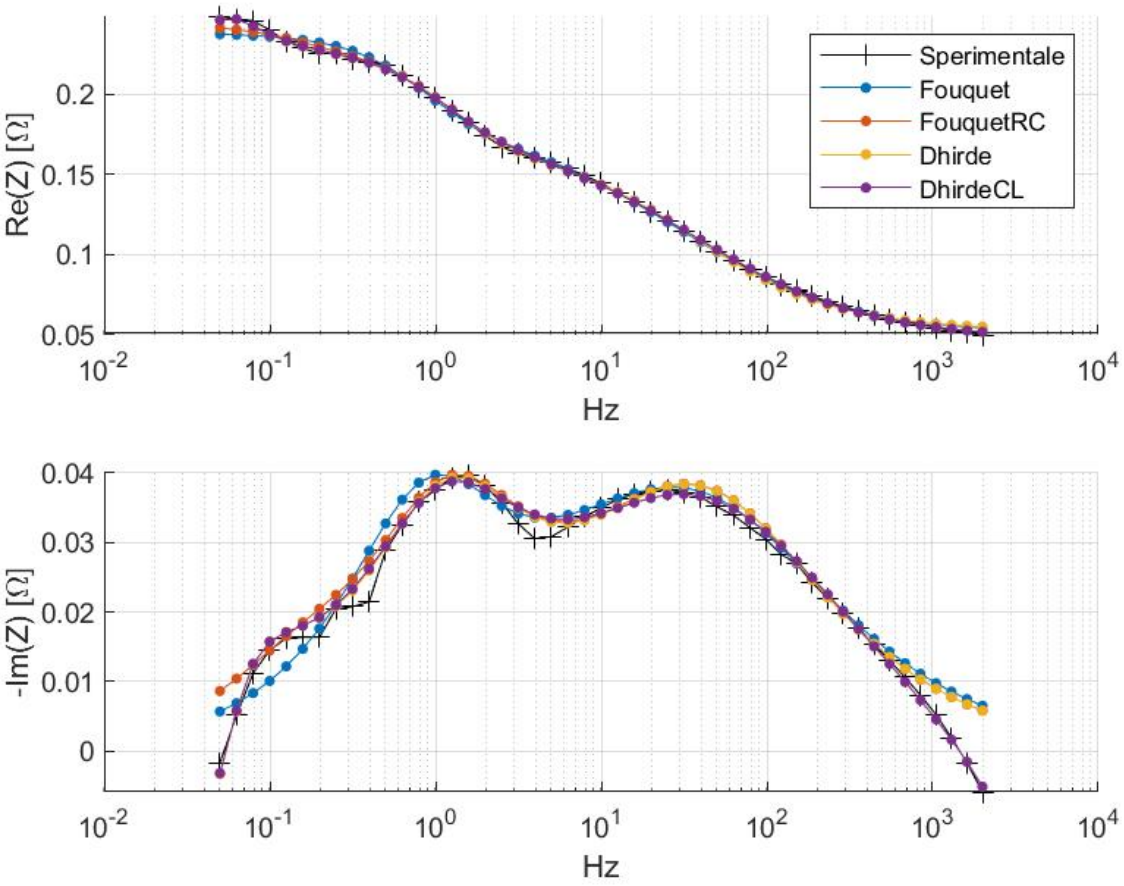
Fobj = 0.04796;

Romega	Rct1	Rct2	Q1	Q2	Phi1	Phi2	Rd	Taud	L
0.0519	0.1131	0.0571	0.1672	2.3548	0.7209	1.0000	0.0294	6.6061	0.0974

DhirdeCL

Fobj = **0.03483**;

Romega	Rct1	Rct2	Q	Phi	Rd	Taud	Lhf	Llf	C
0.0462	0.1259	0.0520	0.2269	0.6459	0.0282	7.1096	0.0000	0.0854	2.7117


Sperimentale
Fouquet
FouquetRC
Dhirde
DhirdeCL
Re(Z) [Ω]
0.2
0.15
0.1
0.05
10-2
10-1
100
101
102
103
104
Hz
-Im(Z) [Ω]
0.04
0.03
0.02
0.01
0
10-2
10-1
100
101
102
103
104
Hz