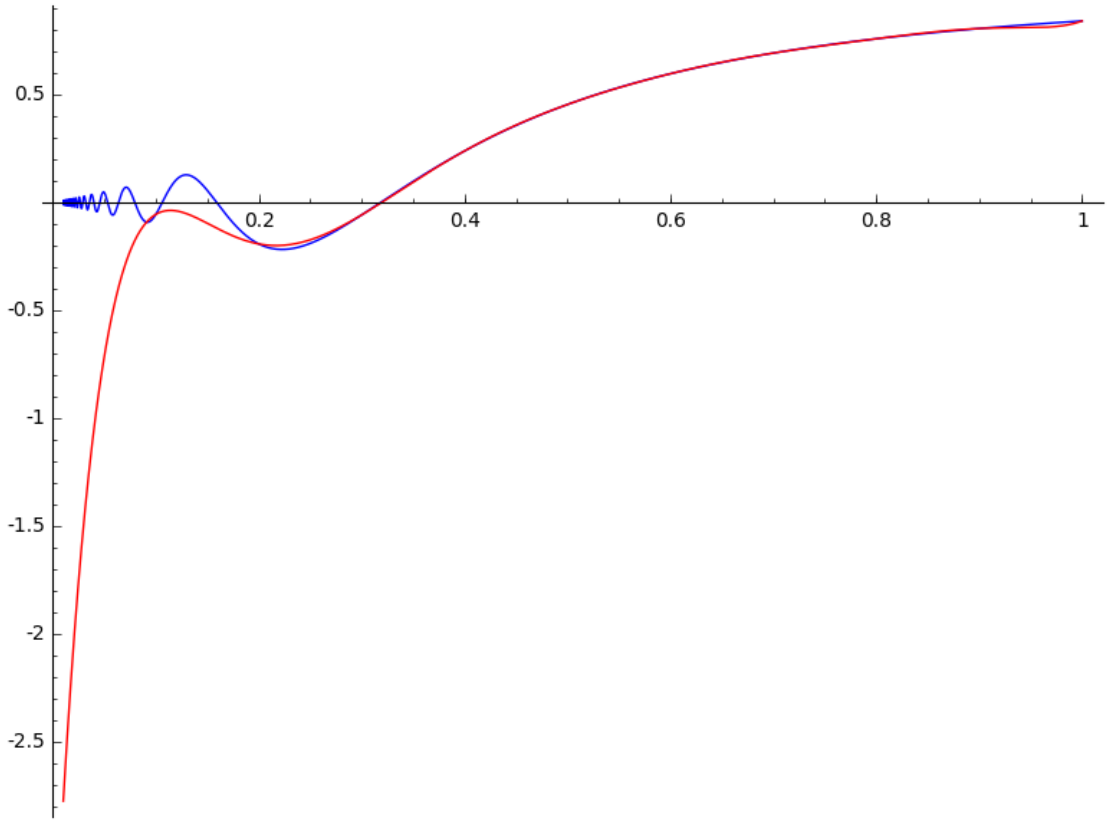
76-APROX-interpolacion

February 5, 2018

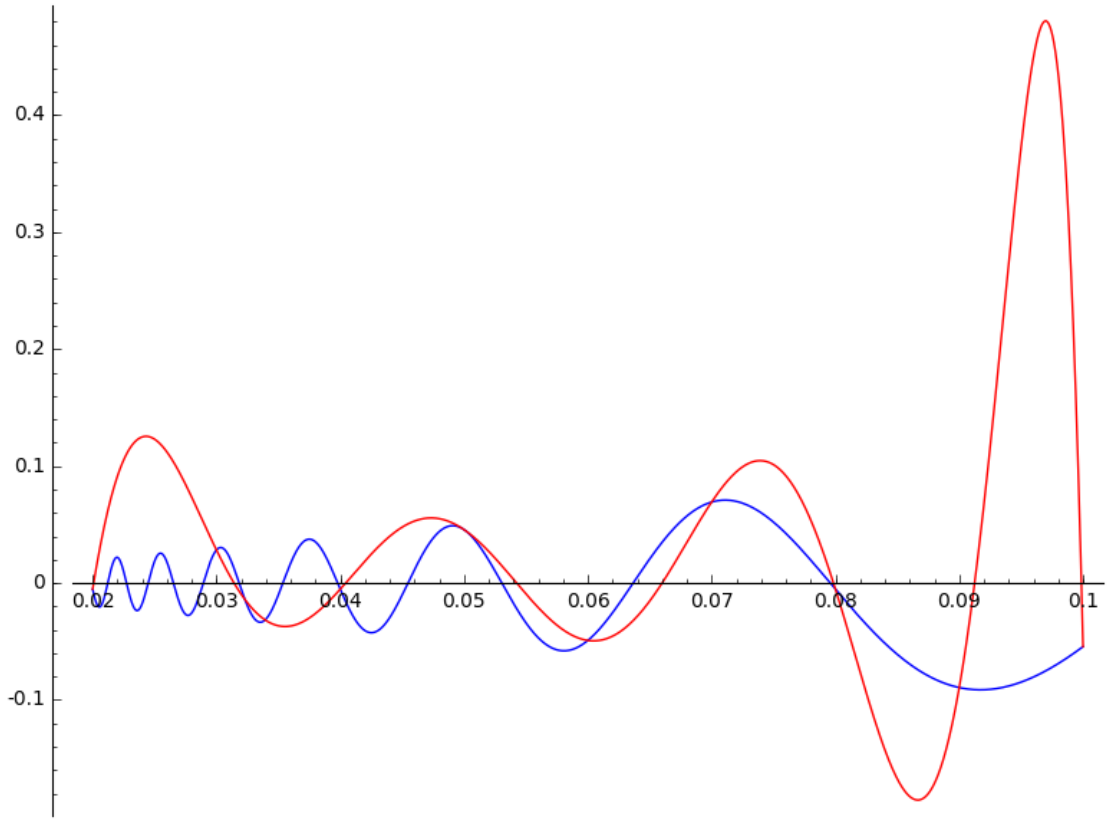
Interpolación de Lagrange

```
In [1]: f(x)=x*sin(1/x)

In [2]: L = zip([n*0.1 for n in srange(1,11)],[f(n*0.1).n() for n in srange(1,11)]);L

Out[2]: [(0.100000000000000, -0.0544021110889370),
         (0.200000000000000, -0.191784854932628),
         (0.300000000000000, -0.0571703888626455),
         (0.400000000000000, 0.239388857641583),
         (0.500000000000000, 0.454648713412841),
         (0.600000000000000, 0.597244774651059),
         (0.700000000000000, 0.692932153460487),
         (0.800000000000000, 0.759187695484469),
         (0.900000000000000, 0.806572980926961),
         (1.00000000000000, 0.841470984807897)]

In [3]: R = PolynomialRing(RR,'x')

In [4]: Lag = R.lagrange_polynomial(L);Lag

Out[4]: 3221.47948876818*x^9 - 17006.0721719921*x^8 + 38705.9902994724*x^7 - 49611.8962430397*x

In [5]: plot(f,0.01,1)+plot(Lag,0.01,1,color='red')

Out[5]:
```



£Podemos forzar al polinomio interpolador a seguir las oscilaciones de f?

```
In [6]: L1 = zip([n*0.01 for n in srange(1,11)],[f(n*0.01).n() for n in srange(1,11)]);L1

Out[6]: [(0.0100000000000000, -0.00506365641109759),
         (0.0200000000000000, -0.00524749707407858),
         (0.0300000000000000, 0.0282158872988629),
         (0.0400000000000000, -0.00529407000391092),
         (0.0500000000000000, 0.0456472625363814),
         (0.0600000000000000, -0.0491068351894767),
         (0.0700000000000000, 0.0692290981703785),
         (0.0800000000000000, -0.00530575178809605),
         (0.0900000000000000, -0.0893999738209419),
         (0.100000000000000, -0.0544021110889370)]

In [7]: Lag1 = R.lagrange_polynomial(L1);Lag1

Out[7]: -5.15258697398176e13*x^9 + 2.54089085015143e13*x^8 - 5.36070933151227e12*x^7 + 6.32307

In [8]: plot(f,0.02,0.1)+plot(Lag1,0.02,0.1,color='red')

Out[8]:
```



Vemos algo que debía ser claro antes de empezar: forzando al polinomio a coincidir con la función en ciertos puntos no se consigue fácilmente que el polinomio se acerque a la función.

Diferencias divididas (Newton)

```
In [9]: New = R.divided_difference(L);New

Out[9]: [-0.0544021110889370,
         -1.37382743843691,
         13.5998604956836,
         -18.3420715799045,
         -55.4965590365788,
         320.892924212446,
         -860.877445163556,
         1645.22664606222,
         -2509.41447253527,
         3221.47948876818]

In [10]: P = sum([New[j]*prod([x-L[k][0] for k in srange(j)])for j in srange(len(L))]);P

Out[10]: 3221.47948876818*(x - 0.100000000000000)*(x - 0.200000000000000)*(x - 0.300000000000000

In [11]: expand(P)
```

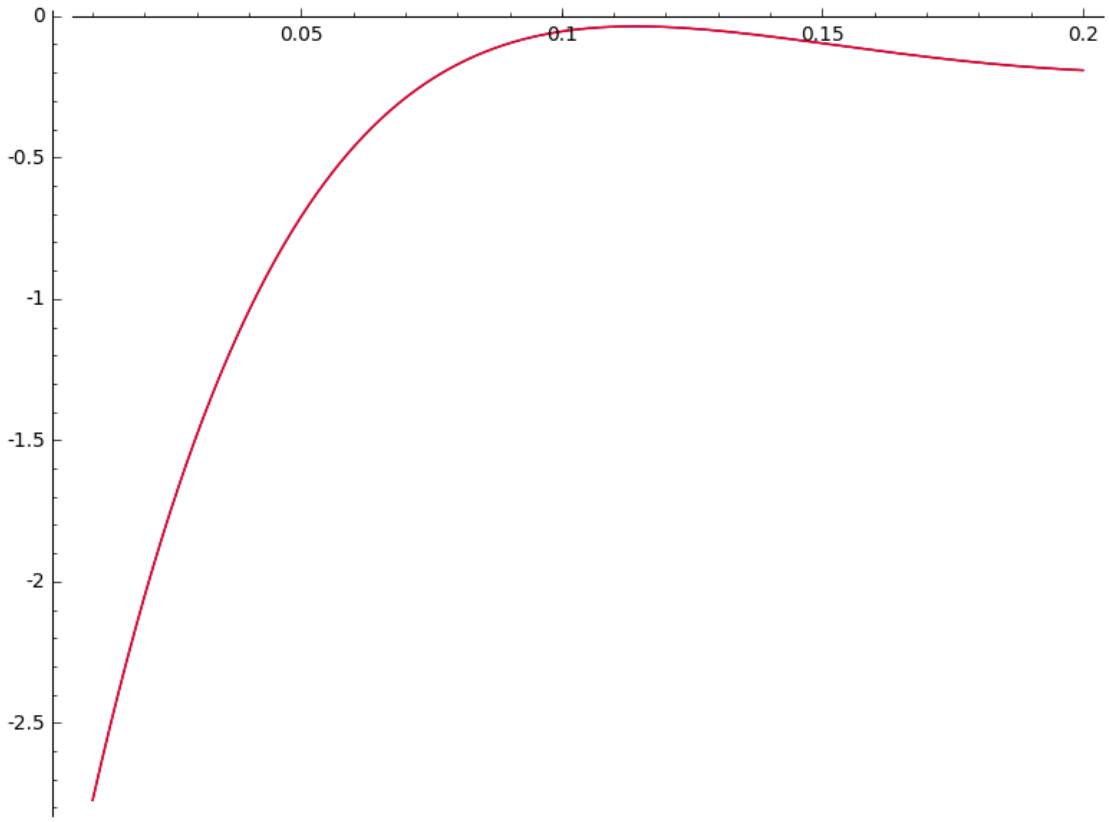
```
Out[11]: 3221.47948876818*x^9 - 17006.0721719921*x^8 + 38705.9902994724*x^7 - 49611.8962430397
```

```
In [12]: R(expand(P))-Lag
```

```
Out[12]: -3.63797880709171e-12*x^8 - 7.27595761418343e-12*x^5 + 2.27373675443232e-13*x^2 - 1.42
```

```
In [13]: plot(P,0.01,0.2)+plot(Lag,0.01,0.2,color='red')
```

Out[13]:




```
In [ ]:
```