

Efficient Computation of Matched Solutions of the KV Envelope Equations for Periodic Focusing Lattices*

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Heavy Ion Fusion Group Presentation

Berkeley, CA

18 January, 2006

* Research supported by the US Dept. of Energy at LBNL and LLNL under contract Nos. DE-AC03-76SF00098 and W-7405-Eng-48

Programs Available at <http://arxiv.org/abs/physics/0602150>

- ◆ `readme.txt` ← Explanatory text
 - ◆ `im_method.pdf` ← Manuscript submitted to PRST-AB
 - ◆ `im_solver.math` ← Contains alterable lattice and beam parameters and generates matched solutions when called, loading in subprograms listed below
 - ◆ `im_lattice.math`
 - ◆ `im_utilities.math`
 - ◆ `im_cont.math`
 - ◆ `im_seed.math`
 - ◆ `im_iterate.math`
 - ◆ `im_diag.math`
- Programs used to generate figures depicted in the manuscript, and the figures themselves, are also included in the given arxiv link

List of Parameters

Lattice Parameters: Needed in all parameterizations

L_p	Lattice Period [meters]
η	Occupancy
α	Syncopation Factor
σ_{0x}	Undepressed Phase Advances
σ_{0y}	

Beam Parameters: Program treats unnecessary values as “dummies” and calculates them from other parameters

Q	Dimensionless Beam Perveance
ε_x	Emittances
ε_y	
σ_x	Depressed Phase Advances
σ_y	

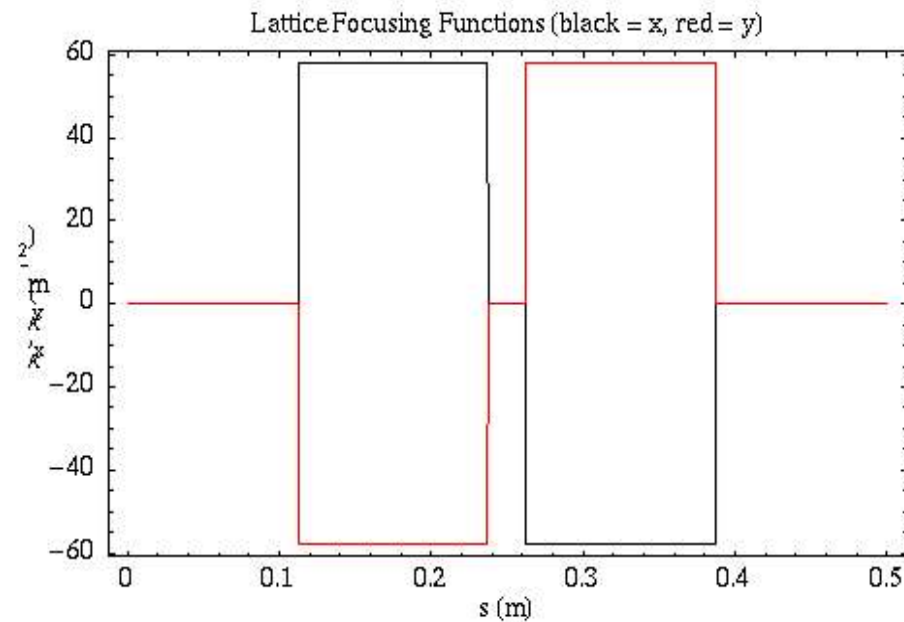
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In[1]:= << im_solver.math
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Matched Envelope Solution -- IM Method

2-21-2006 by sven on ife5

Transport Lattice

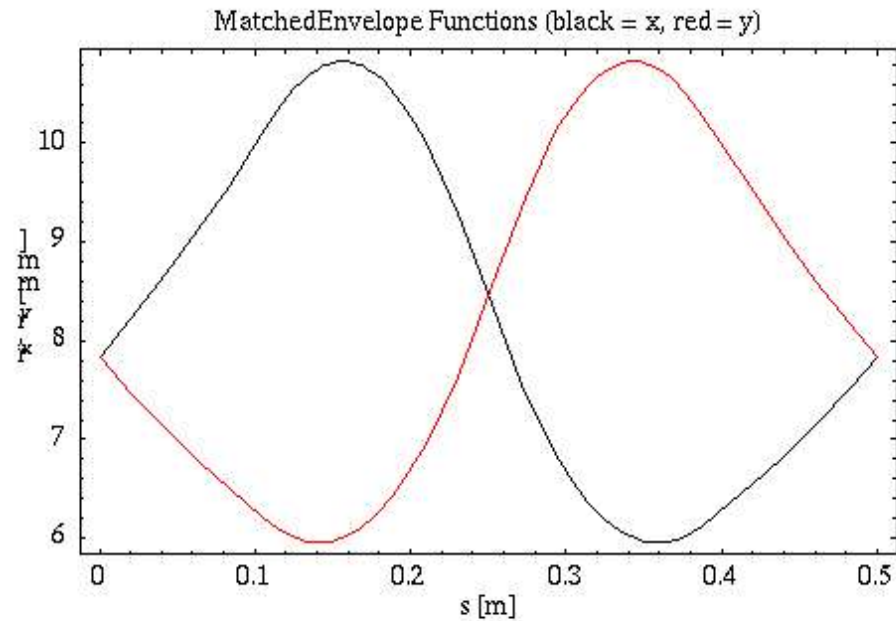
Lattice Type	Quadrupole
Undepressed Phase Advances [deg/period]	
x-plane, σ_{ox} [deg/period]	80.
y-plane, σ_{oy} [deg/period]	80.
Lattice Period, L_p [m]	0.5
Occupancy, η	0.5
Syncopation Factor, α ($\alpha = 1/2 \Rightarrow FODO$)	0.1
Max Focusing Strength, $\text{Max}[\kappa_x, \kappa_y]$, [$1/\text{m}^2$]	57.925



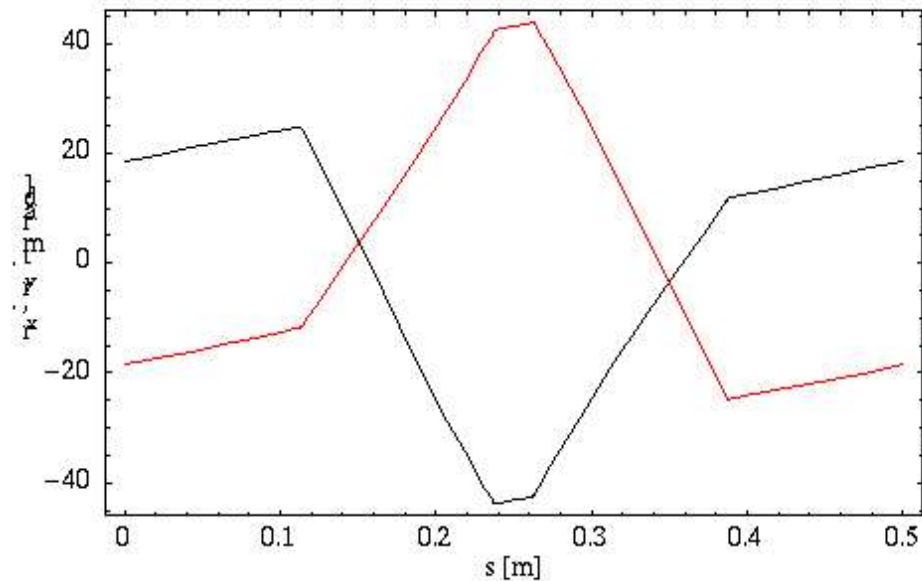
Beam Properties

Dimensionless Perveance, Q	4.1594×10^{-4}
RMS Edge Emittances [m-rad]:	
ϵ_x	$5. \times 10^{-5}$
ϵ_y	$5. \times 10^{-5}$
Depressed Phase Advances [deg/period]	
x-plane, σ_x [deg/period]	24.
y-plane, σ_y [deg/period]	24.
Tune Depressions:	
σ_x / σ_{0x}	0.3
σ_y / σ_{0y}	0.3

Matched Solution



MatchedEnvelope Angles (black = x, red = y)



	x-Horizontal	y-Vertical
Radii, $r_x = 2 \langle x^2 \rangle^{1/2}$, $r_y = 2 \langle y^2 \rangle^{1/2}$:		
Avg (Lattice Period), \bar{r}_x , \bar{r}_y [nm]	8.2116	8.2116
Max, Max[r_x], Max[r_y] [nm]	10.83	10.83
s-locations of Maxs [nm]	156.45	343.55
Min, Min[r_x], Min[r_y] [nm]	5.9584	5.9584
s-locations of Mins [nm]	358.78	141.22
Angles, r_x' , r_y' :		
Max, Max[r_x'], Max[r_y'] [mrad]	24.816	43.763
s-locations of Maxs [nm]	112.5	262.5
Min, Min[r_x'], Min[r_y'] [mrad]	-43.763	-24.815
s-locations of Mins [nm]	237.5	387.51
Matching Conditions:		
Radii, $r_x[0]$, $r_y[0]$ [nm]	7.8353	7.8353
Angles, $r_x'[0]$, $r_y'[0]$ [mrad]	18.534	-18.534
Average Radius Measures:		
$\sqrt{\bar{r}_x \bar{r}_y}$ [nm]	8.0499	



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Average Radius Measures:

$\sqrt{\bar{r}_x \bar{r}_y}$ [nm]	8.0499
$(\bar{r}_x + \bar{r}_y) / 2$ [nm]	8.2116

Matched Solution -- Numerical Parameters

Parameterization Case	2
Specified Fractional Tolerance	$1. \times 10^{-6}$
Achieved Fractional Tolerance	6.6587×10^{-7}
Iterations Needed	5
CPU Time for Solution [sec]	1.91

[env_match_update.] [env_match2.sxi - O] sven@sugreev:~ Tue Feb 21