**Minkwoski Stress Tensor derivation**

|  |
| --- |
|  |
|  |
|  |

**Now consider only**

|  |
| --- |
|  |
|  |
|  |

**Total stress tensor becomes**

**We now consider the x-component of the divergence to get force**

|  |
| --- |
| t1=(1/2)\*(1/(2\*dx)).\*(Dx(i+1,j).\*Ex(i+1,j)-Dx(i-1,j).\*Ex(i-1,j)); |

**With I,j at E\_x locations**

**Abraham Stress Tensor Derivation**

**Goals: only average , when possible only average and**

**Lets place at**

**Amperian Stress Tensor**

**We consider TM mode**

**Again, lets place at**

Matlab implementation

|  |
| --- |
| function [ Tx,t1,t2,t3,t4] = Calculate\_Tx\_AMP (i,j,Ex,Ey,Dx,Dy,Hz,Hz\_n\_prev,Bz,Bz\_n\_prev,dx,dy )    % T1=-eps\_o(t1+t2)+(1/{\mu\_o})t3-eps\_o\*t4  % Place Tx at Ey, (i,j+1/2)    % ic=[i(1)-2:i(end)+2];  % jc=[j(1)-2:j(end)+2];    c=299792458;  mu\_o=4\*pi\*10^-7;    eps\_o=(1/(c\*c\*mu\_o));        % t1=\px(ExEx)  Ex2=(0.5)\*(Ex(i,j)+Ex(i,j+1)); % Solve for Ex at i+1/2,j+1/2  Ex1=(0.5)\*(Ex(i-1,j)+Ex(i-1,j+1));    t1=(1/dx)\*(Ex2.^2-Ex1.^2);    % t2=\px(EyEy)  Ey2=Ey(i+1,j).^2;  Ey1=Ey(i-1,j).^2;  t2=(1/(2\*dx))\*(Ey2-Ey1);    % t3=\px(BzBz)  Bz2=Bz(i,j).^2;  Bz1=Bz(i-1,j).^2;  t3=(1/(dx))\*(Bz2-Bz1);    % t4=\py(ExEy)    Ex2=1/4\*(Ex(i,j+1)+Ex(i-1,j+1)+ Ex(i,j+2)+Ex(i-1,j+2));  Ex1=1/4\*(Ex(i,j)+Ex(i-1,j)+ Ex(i,j-1)+Ex(i-1,j-1));    t4=(1/(2\*dy))\*(Ex2.\*Ey(i,j+1)-Ex1.\*Ey(i,j-1));      Tx(i,j)=(0.5)\*eps\_o\*(-t1+t2)+0.5\*(1/mu\_o)\*t3-eps\_o\*t4;  end |

**Einstein-Laub Formulation**

**Chu Formulation**