```matlab
%Any bus which is assigned bus number = 1, must be connected to reference
clear all
clc
disp('Zbus Building Algorithm')
data=[0 1 0 0.15
    1 2 0 0.1
    1 3 0 0.1
    2 3 0 0.1
    0 2 0 0.075];

num_bus=max(max(data(:,1),data(:,2)));

sz=size(data);
size=sz(1,1);
buses_added=1;
bus_status=zeros(1,num_bus+1);


for n=1:size
    if(data(n,1)==0)
        temp=data(n,1);
        data(n,1)=data(n,2);
        data(n,2)=temp;
    end
    if(data(n,1)>data(n,2) && data(n,2)~=0)
        temp=data(n,1);
        data(n,1)=data(n,2);
        data(n,2)=temp;
    end

end

for n=1:size
    if(data(n,1)==1 && data(n,2)==0)
        temp1=data(1,:);
        data(1,:)=data(n,:);
        data(n,:)=temp1;
    end
end

for n=1:size
    for m=1:size
        if(data(m,1)==n)
            bus1=data(m,1);
            bus2=data(m,2);
            p_bus1=0;
            p_bus2=0;
            for k=1:num_bus
                if(bus_status(1,k)== bus1 && bus1~=0)
                    p_bus1=1;
                end
                if(bus_status(1,k)== bus2 && bus2~=0)
                    p_bus2=1;
                end
            end
            if(bus_status(1,buses_added)==0 && bus2==0 && p_bus1==0)
```

```matlab
    disp('Adding Z=')
    disp(data(m,3)+ 1i*data(m,4))
    disp('between buses:')
    disp(bus1)
    disp(bus2)
    disp('This impedance is added between a new bus and reference')
    buses_added=buses_added+1;
    bus_status(1,buses_added-1)=bus1;
    if(bus1==1)
        Zbus(bus1,bus1)=data(m,3)+1i*data(m,4)
    else
        ssz=length(Zbus);
        Zbus(ssz+1,ssz+1)=data(m,3)+1i*data(m,4)
    end


    disp(' ')
    disp(' ')
elseif(p_bus1==1 && p_bus2==0 && bus2~=0)
    disp('Adding Z=')
    disp(data(m,3)+ 1i*data(m,4))
    disp('between buses:')
    disp(bus1)
    disp(bus2)
    disp('This impedance is added between a new bus and an existing bus')
    buses_added=buses_added+1;
    bus_status(1,buses_added-1)=bus2;
    size_zbus=length(Zbus);
    for var=1:size_zbus
        Zbus(size_zbus+1,var)=Zbus(bus1,var);
        Zbus(var,size_zbus+1)=Zbus(var,bus1);
    end
    Zbus(size_zbus+1,size_zbus+1)=Zbus(bus1,bus1)+ data(m,3)+ 1i*data(m,4);
    Zbus


        disp(' ')
        disp(' ')
    elseif(p_bus1==1 && p_bus2==0 && bus2==0)
        disp('Adding Z=')
        disp(data(m,3)+ 1i*data(m,4))
        disp('between buses:')
        disp(bus1)
        disp(bus2)
        disp('This impedance is added between an existing bus and reference')
        size_zbus=length(Zbus);
        Zbus1=Zbus;
        for var=1:size_zbus
            Zbus1(size_zbus+1,var)=Zbus1(bus1,var);
            Zbus1(var,size_zbus+1)=Zbus1(var,bus1);
        end
        Zbus1(size_zbus+1,size_zbus+1)=Zbus1(bus1,bus1)+ data(m,3)+ i*data(m,4);
        for var1=1:size_zbus
            for var2=1:size_zbus
                Zbus(var1,var2)=Zbus1(var1,var2)-
Zbus1(var1,size_zbus+1)*Zbus1(size_zbus+1,var2)/Zbus1(size_zbus+1,size_zbus+1);
            end
        end
        Zbus
```

```matlab
            disp(' ')
            disp(' ')
        elseif(p_bus1==1 && p_bus2==1 && bus2~=0)
          disp('Adding Z=')
          disp(data(m,3)+ 1i*data(m,4))
          disp('between buses:')
          disp(bus1)
          disp(bus2)
          disp('This impedance is added between two existing buses')
          size_zbus=length(Zbus);
          Zbus1=Zbus;
          for var=1:size_zbus
            Zbus1(size_zbus+1,var)=Zbus1(bus1,var)-Zbus1(bus2,var);
            Zbus1(var,size_zbus+1)=Zbus1(var,bus1)-Zbus1(var,bus2);
          end
          Zbus1(size_zbus+1,size_zbus+1)=Zbus1(bus1,bus1)+Zbus1(bus2,bus2)-2*Zbus1(bus1,bus2)
+ data(m,3)+ i*data(m,4);
          for var1=1:size_zbus
            for var2=1:size_zbus
              Zbus(var1,var2)=Zbus1(var1,var2)-

  Zbus1(var1,size_zbus+1)*Zbus1(size_zbus+1,var2)/Zbus1(size_zbus+1,size_zbus+1);
            end
          end
          Zbus
          disp(' ')
          disp(' ')
        end


    end
  end
end
bus_status

for var1=1:num_bus
  for var2=1:num_bus
    if(bus_status(1,var2)==var1)
      zvar1=Zbus(var2,:);
      Zbus(var2,:)=Zbus(var1,:); %#ok<*SAGROW>
      Zbus(var1,:)=zvar1;

      zvar2=Zbus(:,var2);
      Zbus(:,var2)=Zbus(:,var1);
      Zbus(:,var1)=zvar2;

      z_s=bus_status(1,var1);
      bus_status(1,var1)=bus_status(1,var2);
      bus_status(1,var2)=z_s;
    end
  end
end
Zbus
```