V. NUMERISCHE METHODEN

```
LQ [{x_,y_,z_}]= ((x)^2+(y)^2+(z)^2);
Laenge[{x_,y_,z_}]= Sqrt[LQ[{x,y,z}]];
CrossProd[a_, b_] := RotateLeft[a*RotateLeft[b]-RotateLeft[a]*b];
Koord[{x_,y_}] = {Cos[x]*Cos[y],Sin[x]*Cos[y],Sin[y]};
Polar[{x_,y_,z_}] =
        { Which [ x <  0, Pi+ArcTan[ y/x ], x == 0, Sign[y] * Pi/2 ,        x >  0, ArcTan[ y/x ]  ] ,
          ArcSin[z]};
EulerVektor := Module[{},
        Do [grd = 0;
        Do [ If [Inzidenz[[i+1,j]]==1,grd = grd+1], {j,1,2n-4}];
        Grad[[i]] = grd, {i,1,n}] ]

Zeige := Module [{},
        Clear [i,j,k, Dreieck];
        F = Table[0,{s,1,2n-4},{t,1,3}];
        Do[Dreieck = Table [0,{s,1,3},{t,1,3}];
                PolyNr = 1; Vl = 0;
                Do[ If [(Inzidenz [[k+1,j]]==1), (Dreieck [[PolyNr]] = Punkte[[k]];
                        PolyNr = PolyNr+1)], {k,1,n}];
                F[[j]] = Polygon[Dreieck],
        {j,1,2n-4}];
        Show[Graphics3D[F,ViewPoint->Sicht], Lighting->True]  ]

Suche := Module[{index},
        Do [index:= Which[k+i<n+1,k+i, k+i>n, k+i-n];
        If [(Inzidenz [[index+1,j]]==1)&&(index!=i),
                (Dreieck [[PolyNr]] = Punkte[[index]]; PolyNr = PolyNr+1),
        ],{k,0,n-1}]; ];

Durchlaufen := Module [{},
        Clear [i,j,k,Dreieck, Kreuz, diffz,cp];
        Entscheidung = 0;
        Do[ diffz = 0;
                Kreuz   = Table [0,{s,1,3}]; Dreieck = Table [0,{s,1,3},{t,1,3}];
                Dreieck [[1]] = Punkte[[i]];
                Do[ If[ Inzidenz[[i+1,j]]==1 ,
                        PolyNr = 2; Ortg = Inzidenz [[1,j]];
                        Suche; cp = Table[0,{s,1,3}];
                        cp = CrossProd[Dreieck[[2]],Dreieck[[3]] ];
                        Kreuz = Kreuz+(-1)^(Ortg)*cp],
                {j,1,2n-4}];
                lg = N[Laenge[ Kreuz ],10] ; Kreuz = N[ Kreuz /(lg) , 12];
                diffz = LQ[Punkte[[i]]-Kreuz]; Entscheidung = Entscheidung + diffz;
                Punkte [[i]] = Kreuz;
                Clear[Dreieck,diffz, cp, Kreuz],
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        {i,1,n}] ; ]


Polyeder := Module [{},
        Clear [i,j,k, Dreieck];
        Vol = 0;
        F = Table[0,{s,1,2n-4},{t,1,3}];
        Do[Dreieck = Table [0,{s,1,3},{t,1,3}];
                PolyNr = 1; Vl = 0;
                Do[If [(Inzidenz [[k+1,j]]==1),
                        (Dreieck [[PolyNr]] = Punkte[[k]]; PolyNr = PolyNr+1)],
                {k,1,n}];
                Ortg = Inzidenz [[1,j]];
                Vl = (-1)^(Ortg)*N[Det[Dreieck],18];
                F[[j]] = Polygon[Dreieck];
                Vol = Vol+Vl,
        {j,1,2n-4}];
        Clear[Dreieck]; Vol = Vol/6;
        Show[Graphics3D[F,ViewPoint->Sicht], Lighting->True];
        Print["Volumen = ", Vol] ]

LokalesVolumen := Module [{Untersucht},
        Clear [i,j,k, Dreieck];
        Vol = 0; Untersucht = Table[0,{t,1,2n-4}];
        Do[i = index[[ind]];
        Dreieck = Table [0,{s,1,3},{t,1,3}];
                Dreieck [[1]] = Punkte [[i]];
                Do[ If[(Inzidenz[[i+1,j]]==1)&&(Untersucht[[j]]!=1),
                        Untersucht[[j]] = 1;
                        Ortg = Inzidenz [[1,j]];
                        PolyNr = 2; Suche;
                        Vol = Vol+(-1)^(Ortg)*N[Det[Dreieck]],18],
                {j,1,2n-4}],
        {ind,1,4}]]


(* SucheKante: Sucht die kn-te Kante der j-ten Fläche   *)
(* sowie das angrenzende Dreieck                        *)

SucheKante[j1_,kn_] := Module [{stelle},
        ptr = 1; index   = Table [0,{s,1,4}];
        Do[Ortg = Inzidenz[[1,j1]];
                If [Inzidenz[[i+1,j1]] == 1,
                        stelle = Mod[ptr+2*kn,3]+1;
                        index[[stelle]] = i; ptr = ptr+1],
        {i,1,n}];
        index[[4]] = index[[3]]; index[[3]] = index[[2]];
        If [Ortg == 0,index[[2]] = 0,
                (index[[2]] = index[[4]]; index[[4]] = 0)];
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    Do [ k2 = Which[k+j1<(2n-4)+1,k+j1, k+j1>(2n-4),k+j1-(2n-4)];
        If [(Inzidenz[[index[[1]]+1,k2]] == 1)&&(Inzidenz[[index[[3]]+1,k2]] == 1),
            j2 = k2;
            Do[ If [ (Inzidenz[[i+1,k2]] == 1)&&(i!=index[[1]])&&(i!=index[[3]]),
                (If[ Inzidenz[[1,j1]] == 1,
                    index[[4]] = i,index[[2]] = i])],
            {i,1,n}]],
    {k,1,2n-5}]]


KreuzeKante:= Module[{},
    Inzidenz[[index[[1]]+1,j1]] = 0; Inzidenz[[index[[1]]+1,j2]] = 1;
    Inzidenz[[index[[2]]+1,j1]] = 1; Inzidenz[[index[[2]]+1,j2]] = 1;
    Inzidenz[[index[[3]]+1,j1]] = 1; Inzidenz[[index[[3]]+1,j2]] = 0;
    Inzidenz[[index[[4]]+1,j1]] = 1; Inzidenz[[index[[4]]+1,j2]] = 1;

    (*Orientierung der Dreiecke*)
    Ortg = 0;
    If [index[[2]]<index[[3]],Ortg=Ortg,Ortg=Ortg+1];
    If [index[[2]]<index[[4]],Ortg=Ortg,Ortg=Ortg+1];
    If [index[[3]]<index[[4]],Ortg=Ortg,Ortg=Ortg+1];
    Ortg = Mod[Ortg,2]; Inzidenz[[1,j1]] = Ortg;

    Ortg = 0;
    If [index[[4]]<index[[1]],Ortg=Ortg,Ortg=Ortg+1];
    If [index[[4]]<index[[2]],Ortg=Ortg,Ortg=Ortg+1];
    If [index[[1]]<index[[2]],Ortg=Ortg,Ortg=Ortg+1];
    Ortg = Mod[Ortg,2]; Inzidenz[[1,j2]] = Ortg;
    ]


AddiereEcke := Module [{Pneu,Izd},
    n = n+1;
    Izd  = Table[0,{i,1,n+1},{j,1,2n-4}];
    Do [Izd[[1,j+2]]= Inzidenz[[1,j]],{j,1,2n-6}];
    Do [Izd[[i+2,j+2]] = Inzidenz[[i+1,j]],{i,1,n-1},{j,1,2n-6}];

    Nr = 1; ind = Table [0,{s,1,3}];
    Do [If[Inzidenz[[i+1,1]] == 1, ind[[Nr]] = i; Nr = Nr+1],{i,1,n-1}];

    If [Inzidenz[[1,1]] == 0,
        Izd [[1,1]]= 0; Izd[[1,2]]= 0; Izd[[1,3]]= 1,
        Izd [[1,1]]= 1; Izd[[1,2]]= 1; Izd[[1,3]]= 0];
    Do[Izd [[    2    , j ]] = 1,{j,1,3}];
    Do[Izd [[ ind[[i]]+2, j ]] = 1,{i,1,3},{j,1,3}];
    Izd[[ind[[3]]+2,1]] = 0;  Izd[[ind[[1]]+2,2]] = 0;  Izd[[ind[[2]]+2,3]] = 0;

    Inzidenz = Table[0,{i,1,n+1},{j,1,2n-4}];
    Inzidenz = Izd; Clear[Izd];
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        Pneu = Table[0,{i,1,n},{j,1,3}]; Pkt  = Table[0,{s,1,3}];
        Do [Pneu[[i+1]] = Punkte[[i]],{i,1,n-1}];
        Pkt = Sum [Punkte[[ ind [[i]] ]],{i,1,3}];
        Pkt = Pkt/Laenge[Pkt]; Pneu [[1]] = Pkt;

        Clear[Pkt,Pneu] ]


ZwischenSchritt[j1_,kn_] := Module [{Iz,Pk},
        Iz = Inzidenz; Pk = Punkte;
        SucheKante[j1,kn];
        If [Bearbeitet[[j1,j2]] != 1,
                Bearbeitet[[j1,j2]] = 1; Bearbeitet[[j2,j1]] = 1;
                LokalesVolumen; VolAlt = Vol;
                KreuzeKante;

                Entscheidung = 1;
                While [Abs[Entscheidung]>Toleranz,
1.  LokalesDurchlaufen];
                LokalesVolumen;
                VolNeu = Vol;

                If[(VolAlt-VolNeu)> 0,
                        NeuesPolyeder=0; Inzidenz = Iz; Punkte = Pk, NeuesPolyeder=1]]
        ]


(*main*)

While[n < 27,
        (Sicht = {1,2,1};
        Grad = Table[0,{i,1,n}];
        Durchlauf = 0; Toleranz = 10^(-4);
        Prisma; Polyeder; Kt = 0; Print ["Polyeder fuer ",n];

        Timing[
                While [Kt < 6n-12,
                Bearbeitet = Table[0,{s,1,2n-4},{t,1,2n-4}];
                EulerVektor;Print[Grad]; Kt = 0;

                Do [ZwischenSchritt[j1,1];
                        If [NeuesPolyeder == 1,Break[],Kt = Kt+1];      ZwischenSchritt[j1,2];
                        If [NeuesPolyeder == 1,Break[],Kt = Kt+1];      ZwischenSchritt[j1,3];
                        If [NeuesPolyeder == 1,Break[],Kt = Kt+1],
        {j1,1,2n-4}];];

        Entscheidung = 1;
        While [ Abs[Entscheidung]>Toleranz, Durchlaufen];
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        Polyeder;];
        AddiereEcke;)
]
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